



FRIDAY, MARCH 15, 1895.

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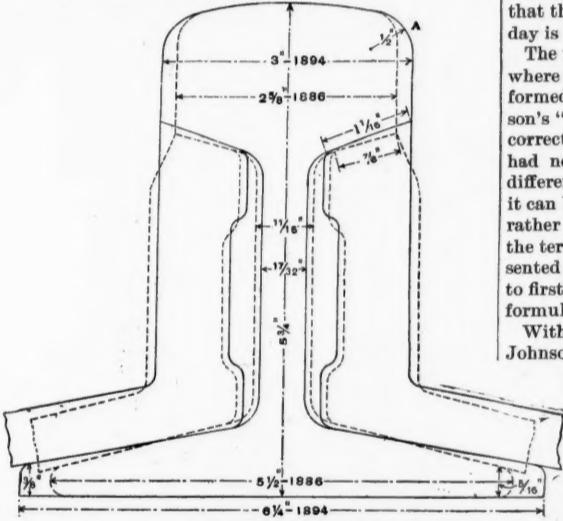
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Contributions.

Mr. Sandberg's Rail Sections.

LONDON, Dec. 22, 1894.

TO THE EDITOR OF THE RAILROAD GAZETTE:
I see in your issue of Dec. 14 my letter of Nov. 28, on the 110-lb. rails for Penge Tunnel, London, Chatham & Dover Railway, you have added "C. P. Sandberg's section." I certainly designed the section, but, as I stated, for a special case, where I was bound to use the old fish-plates and no base plates.



Sandberg's 100-lb. Rails.
(The dotted lines show the section of 1886; the full lines show the section of 1894.)

In order not to produce a confusion between this and my standard sections for 100-lb. designs, 1886 and 1894, hereby inclosed, perhaps you would find it worth your while to explain this. I should have also stated that the corrosion and wear was 2 lbs. per yard per year, which speaks for the necessity of a heavier rail.

C. P. SANDBERG.

Calculation of Three-Level Cross-Sections.

CHATTANOOGA, Tenn., March 5.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In 1888 the writer was called upon to re-measure and re-classify the material used in the construction of about twenty miles of railroad. Part of the road had ties and rails laid, and the rest was in process of construction. No profile was available. A dispute had arisen between the contractors and the owners of the road. The owners objected decidedly to having any re-measuring done and orders were given to prevent anything of the kind.

It will readily be seen that the requirements, "Get it right," were hard to fill. It was necessary, for the most part, to assume that the natural surface slopes were uniform, and as the side slopes were not always the same, in fact, varied very much, it was decided to measure the width at each station from the center of the road-bed and determine by the level the difference in elevation of the top of the road-bed and the out edges of the cuts and fills.

The notes read something like this, $\frac{+12.5}{24.8} - C - \frac{+20.8}{37.2}$

indicating that at this particular station there was a cut, and that on the one side the top of the cut was 24.8 ft. from the center of the roadbed and 12.5 ft. above it, and on the other the top was 37.2 ft. from the center and 20.8 ft. above it. In fills, the notes were in the same form except that — was used in place of + with the upper figures.

It was necessary to have the estimate of the quantities ready in a limited time. To accomplish this a formula was studied out and reduced to the following rule, viz: Multiply each side depth by the road-bed width, plus the slope width on the other side. Add the products, and divide by two. The rule is quite simple and will apply wherever the natural surface slope is uniform, no matter whether the side slopes are alike or not. The formula was derived as follows

$$(1) A = \frac{(a + x + x + b)(c + d)}{2} - \frac{a c}{2} - \frac{b d}{2}$$

Reduced.

$$(2) A = \frac{c(2x + b) + d(2x + a)}{2}$$

In the same connection it was determined to prepare a rule for the calculation of any three level cross section, and the following was the result, viz.: Multiply the extreme width by the center depth; add the product of the sum of the side depths by half the road-bed, and divide the sum by two. The formula prepared, from which it was derived, is as follows:

$$(1) \text{Total width} = 2x + b e + c e.$$

$$(2) A = \frac{(a + b)(x + b e) + (a + c)(x + c e)}{2}$$

$$\frac{b^2 e}{2} - \frac{c^2 e}{2}.$$

Reduced and grouped,

$$(3) A = \frac{a(2x + b e + c e) + x(b + c)}{2}.$$

While the former rule is of very limited application, the latter will be found very convenient. The necessity of plating is entirely avoided in such sections, and while at first it might appear that the rule is a little awkward to use, yet it will be found after fifteen minutes' use (and it is thoroughly in mind), that the calculations are made very quickly direct from the notes, and that the number of sections that can be calculated in a day is very large.

The writer had never seen the rule or formula else where until in February of this year, when he was informed that the same formula was to be found in Johnson's "Surveying," 1886. Investigation showed this to be correct, the only difference being that the Prof. Johnson had not reduced his formula to a rule and had used different terminology. It seems to the writer that where it can be readily done, it is much better to give a rule rather than a formula to a calculator, especially when the terms used in the rule are the same as those presented as a basis of calculation. This makes it necessary to first find out the meaning of the symbols used in the formula.

Without desiring to enter into a criticism of Professor Johnson's valuable work, it would appear that his method of determining center heights, as given in section 316, would hardly be very satisfactory. As understood, he draws the surface and grade lines carefully on cross-section paper and then takes off the height or depth of grade at each station, presumably from and by means of the cross section squares, as no other reason appears for transferring what properly belongs on profile paper to cross-section paper. Why not determine from the profile the summit and bottom of each particular continuous grade?

and from the number of stations determine the increment for each? Then, beginning at the station at the bottom of the grade, add it for each succeeding station, and put the result in the proper column after the elevation of the surface. The difference between the elevations at any station will give the center cut or fill to be placed in its proper column. No plating other than the profile is necessary, and valuable time is saved.

Speaking of grades, it has occurred to the writer that too little attention is given them after the road is constructed. Accounts are often given of the great care taken to preserve the alignment, but little, if anything, is ever seen written upon keeping the grade right, and yet it is just as important as the alignment. Recently the writer saw a section on one of the main roads of the country where what had originally been a $1\frac{1}{2}$ per cent. grade, at the beginning of a six-degree curve, had become a $2\frac{1}{2}$ per cent. grade. It was at the junction of a deep fill, with a side-hill cut. Many other instances have doubtless been seen by others. On a tangent the trackman can readily tell with his eye whether the grade is kept up, but on a curve his eye fails him, and frequent leveling up with an instrument or the setting of permanent level or grade benches for his use would doubtless change the amount of wear and tear on the engines, and in some cases the load hauled.

BENJ. THOMPSON.

Railroad Signaling.*

This is a long and interesting address. It is largely elementary and we shall therefore omit mention of many of the paragraphs. The speaker confined himself to fixed signals and began with a historical sketch.

*Abstract of a paper by Mr. W. M. Grafton, Signal Engineer of the Pennsylvania Lines West of Pittsburgh, before the University of Wisconsin, Feb. 15, 1895.

American railroads had done a little in block signaling before interlocking was introduced from England in 1874. The first American interlocking machine on the Pennsylvania was made in 1876, and on the New York Central in 1875. These were built in the railroad shops, but now no road builds its own machines, though the larger roads erect the machines with their own men. Speaking of concentration of switches, Mr. Grafton says he knows of several over 1,000 ft. from the tower and one at New River, Va., 2,031 ft. from the tower; and this is on a 9-deg. curve. Signals should be located at the right hand of and next to the track which they govern. Mr. Grafton thinks it will not be long before signals will be placed on bridges much more generally than they now are, though he thinks a still better way of avoiding the use of bracket posts is to separate the tracks so that a semaphore post may be placed between each two tracks. This has already been done on some roads. [At the Broad Street Station in Philadelphia, at the outer end of the train-shed each of the signals, both in-bound and out-bound, is on a separate post.] The Pennsylvania Lines west of Pittsburgh, were the first to do away with a multiplicity of arms on a single post and to adopt the practice of using but two, the upper for the fast route and the lower for all diverging routes. Practice has shown that indicators on the lower arms are unnecessary. The engineers do not get any benefit from them and they are costly to put up and maintain. They have not been used much since 1890 and most roads have abandoned those they had. Like some other devices, they were put up chiefly to carry out a theory.

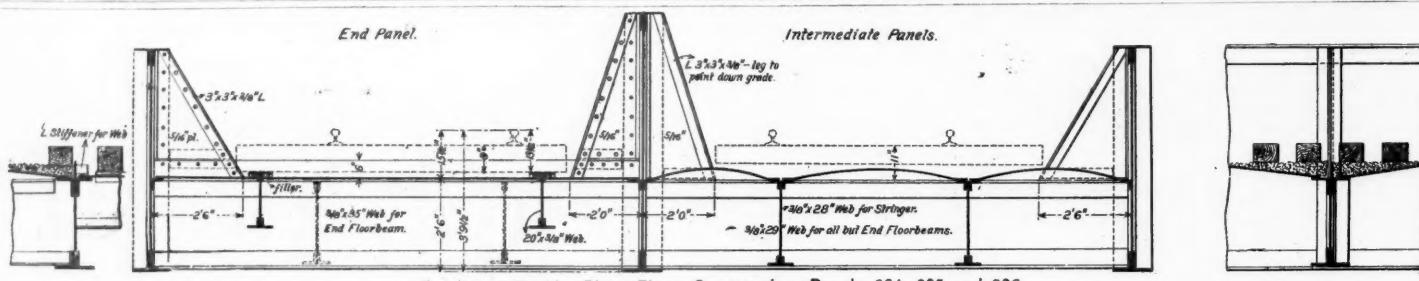
Referring to the expression "pulling a signal clear," Mr. Grafton says that the vertical rod attached to the semaphore arm should always be so fixed that it will push the signal to the clear position. Then, in case of breakage, the weight of this rod helps to pull the signal to the danger position. Electric repeaters, to indicate to the signalman the position of an arm which is located out of his sight, is deemed unnecessary. Mechanical apparatus can be made to work with such certainty that the expense is not justified.

Interlocking machines are different from all other machinery in that they cannot be completed and put together in the factory. Material for bridges, steel buildings, etc., can be finished in the shop, and even that for stone bridges; but interlocking apparatus, except the machine proper, can be better fitted on the ground. Horizontal locking is better than vertical, because in the latter all lost motion from wear and tear takes place in one direction. The use of pipe connections for home signals has increased during the past two years and ought to become general. Electric locks, for locking the flops of conflicting levers, by the automatic action of a track circuit, after a train has passed a signal, are an unnecessary complication. The speaker seems to think that they cannot be kept in a sufficiently high state of efficiency to avoid delay to trains.

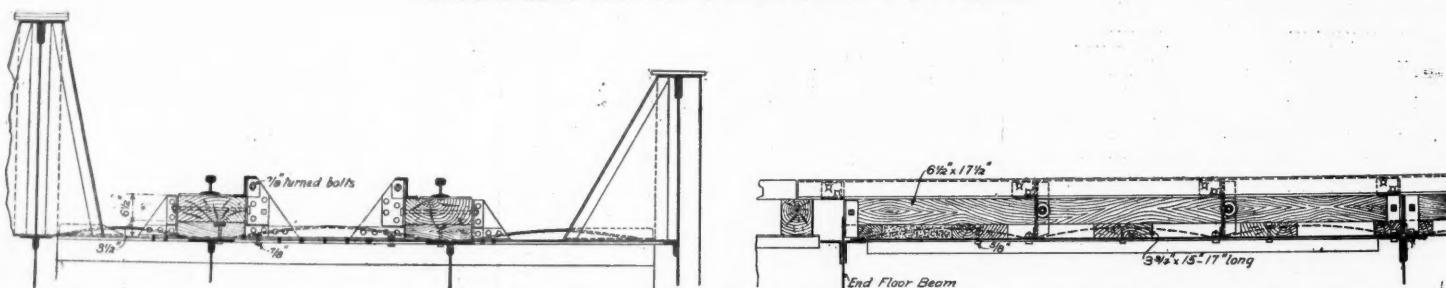
Speaking of selectors, Mr. Grafton thinks that nothing more complicated than a two-way selector should be used. Where there are more than this number of connections the adjustment requires such careful attention that delays to trains are generally unavoidable. Under the head of compensators, Mr. Grafton describes the lazy jack compensator for pipe connection and says it is satisfactory, but wire compensators he dismisses with the single word that not one of those thus far introduced has given satisfaction. The author next takes up block signaling and gives a brief description of the principal kinds of apparatus. From this he goes on to power plants and says that the first pneumatic machine was put into service at West Philadelphia in 1876; the first hydraulic machine at Wellington, O., in 1880; the first hydro-pneumatic machine at Bound Brook, N. J., in 1884; the first electric machine at Cincinnati in 1890, and the first electro-pneumatic at the Jersey City Pennsylvania Railroad terminal in 1891.* The last is the only one of these that has given good results. These machines were not described in detail.

Mr. Grafton closed with a statement of the "signal problems" of the present day. First, we need a good wire compensator, which will perfectly counteract expansion and contraction, but cease to do this when the operator starts to move the signal, and will allow the signal to go to danger whenever any connection breaks. The detector bar needs to be improved. It has to be made so light that it can be readily pulled over the center; the center must be high to avoid clogging by dirt and ice; breakages are frequent and a light, strong bar, easy to work, is yet to be made. The facing point lock is not satisfactory. A switch connection has been known to break so that the switch lever could be moved and the operator go through the motions of locking the switch in the new position, when in fact the locking bar had gone into the same hole as before. On the Pennsylvania Lines they are trying a staggered lock, to prevent an error of this kind. With the staggered lock there are

*Prior to 1891, Westinghouse pneumatic signals were operated by means of electricity, water and air. The main air pipes conveyed the power for operating both signals and switches. This power was governed by valves located close to the switch or signal to be operated; valves for signals were operated by electro magnets as now, but those for switches were operated by compressed air conveyed through an independent pipe separate from that used to move the switch. To insure quick action the horizontal portion of this independent pipe (under ground) was filled with liquid, so that the valve would be more quickly moved by any impulse from the air, the liquid being inelastic. In machines now built a combination of electro magnets is fixed at each switch so as to control the admission of air to the switch movement by an electric current and the fluid pipe for controlling valves is done away with. The Jersey City plant was also the first in which mechanical and electric locking were applied in the same machine.



Details of Buckle Plate Floor Construction, Panels 304, 305 and 306.



Longitudinal Section and Cross Section at Floor Beams, Showing Details of Track and Guard Rail.

two lock bars of different shapes and with different shaped holes, so that if the switch remains stationary and the switch-lever is reversed the lock cannot be operated and therefore the signal cannot be cleared.

The color for semaphore blades is regarded as one of the problems of the day, though Mr. Grafton's lines have used yellow for the face of all arms about six years. He would have spoken with greater accuracy if he had said this was a problem with other roads but not with his own. Discussing the problem of suitable colors for night signals, Mr. Grafton concludes that he is satisfied to continue the use of white lights for all clear. As far as street and dwelling house lights are concerned he thinks that an engineman is as likely to be deceived by a colored light not intended for him as he is by white lights; and the breakage of glasses can be sufficiently provided against by the use of wire glass.

New Elevated Structure of the St. Louis Terminal Railroad Association.

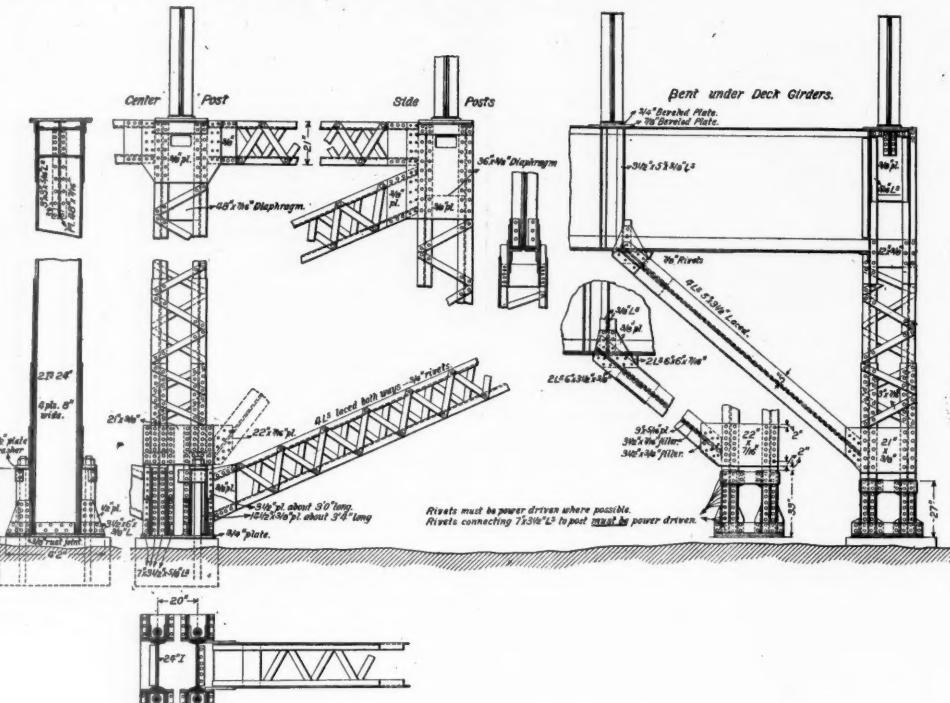
A new elevated structure is now being completed by the Terminal Railroad Association of St. Louis, which has been designed to connect the Merchants' Bridge lines with the main tracks of the Terminal Railroad Association, at a point near Twelfth and Poplar streets. From here it connects with the Union Station, thus giving the Chicago, Burlington & Quincy, and the Missouri, Kansas & Texas, as well as all other roads which connect with the Merchants' Bridge, entrance to the Union Station. We show a map of this part of the city, which, however, is not drawn accurately to scale in all parts. The details of tracks about the Union Station, K, are also not up to date.

The original plan contemplated a surface track connection with the Terminal Association's tracks near Twelfth street. This, however, would have crossed the freight yards of the Missouri Pacific at a point where the greatest amount of switching is done, and the damages were assessed at a figure so high as to render the plan impracticable. As is seen from the map, the line decided upon is a reversed curve from W to H which crosses, overhead, the Seventh street yards of the St. Louis & San Francisco, and the Missouri Pacific, and also the main tracks of the Terminal Railroad Association from the tunnel to Union Station. At this point the iron work ends, and there is a timber trestle, 615 ft. long, descending on a grade of 2 per cent., on the line of tracks 5 and 6 of the old Union Depot, reaching the surface about 400 ft. west of the Twelfth street bridge. This bridge will be rebuilt, and when rebuilt it will be so raised that the grade of the elevated tracks will be reduced to about 1 per cent., and then the temporary trestle will be replaced by an iron structure partly and partly by earth embankment. There is also a short stretch of earth embankment, lying west from a point near W, on the map.

Several difficulties were encountered during the course of the work. In one instance, a pier came directly over a large sewer. To overcome this difficulty, foundations were put on either side of the sewer, and a floor of iron beams was built over it. Upon these the pier proper was erected.

The structure is double track throughout and has reverse curves, with about 150 ft. of tangent between curves. At the East end the curves are 11° and 12°, at the West end, 9° and 10° respectively. There are about 200 ft. of spiral at each end of curves.

The iron work is 900 ft. long and cuts through the St. Louis & San Francisco and Missouri Pacific freight houses. As it cuts the buildings on a skew, the roof had to be cut to the proper width, and the roof trusses were blocked up, cut off and supported upon brackets on girders of the structure after these were erected. The columns of the structure come within the wall lines and post lines of the building and do not interfere with the handling of freight any more than did the original posts of the building. The structure forms a roof over the building and has a buckle plate floor covered with asphalt.

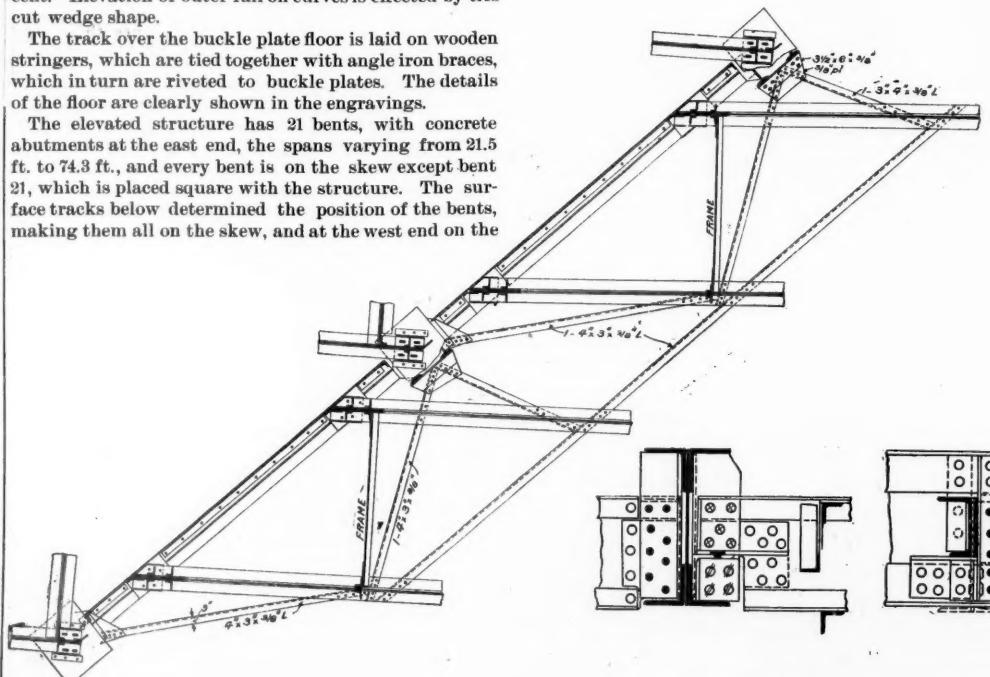


Details of Bents Under Through and Deck Girders, Showing Post Anchorage.

The maximum grade on the iron structure is 1.2 per cent. Elevation of outer rail on curves is effected by ties cut wedge shape.

The track over the buckle plate floor is laid on wooden stringers, which are tied together with angle iron braces, which in turn are riveted to buckle plates. The details of the floor are clearly shown in the engravings.

The elevated structure has 21 bents, with concrete abutments at the east end, the spans varying from 21.5 ft. to 74.3 ft., and every bent is on the skew except bent 21, which is placed square with the structure. The surface tracks below determined the position of the bents, making them all on the skew, and at the west end on the



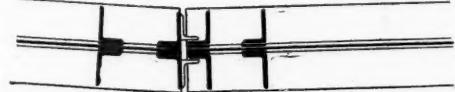
Section and Details of Bents 304 and 307, Showing Skew.

DETAILS OF ELEVATED STRUCTURE—ST. LOUIS TERMINAL RAILROAD ASSOCIATION.

curve they are on such a skew that the girders of adjoining bents in opposite sides lap by each other.

The bracing for the structure had to be entirely done from the anchorage of the foundations, and the columns

not only perform the work of a column, but also that of a beam. On this account the foundations and anchor bolts are very heavy; each pier on the curve has two 8 1/2 in. and two 2 1/2 in. anchor bolts, varying in length from



Expansion Joints for Stringers and Girders.

12 to 16 ft. The engraving shows the details of the anchorage connection.

The piers contain from 20 to 144 cu. yds. of concrete. The columns are each composed of two I-beams, latticed together, with angles on the side extending 3 ft. above top of cap. These angles form brackets for the anchor bolts.

The iron work was all erected with a traveler having a 60 ft. boom, and was all brought from the rear, as needed, and set in place without interfering with the traffic on any track below. It was furnished by the Union Bridge Company, but all erection and foundation work was done by the Terminal Railroad Association.

The abutment at the east end is of concrete, on clay foundation. All the piers up to bent No. 16 are on solid rock foundations, and the remainder are on piling foundations. The piles extend from a point 30 to 88 ft. below the bottom of the pits, to solid rock. All the piers are of concrete, composed of one part Portland cement, three parts sand and seven parts macadam. The cap stones are all granite. The quantities were about as follows:

Total weight iron work.....	1,919,243 lbs.
Lumber on iron work, all long leaf yellow pine.....	214,630 ft. B. M.
Concrete in piers and abutment.....	2,415 cu. yd.
Granite caps.....	1,355 cu. ft.
Piling.....	6,500 lin. ft.
Trestle piling.....	1,070
Trestle lumber, all long leaf yellow pine.....	215,500 ft. B. M.

The work was begun in July, 1894, and the structure will be opened to traffic on March 17, 1895. It has been under charge of Mr. H. P. Taussig, Chief Engineer, Terminal Railroad Association.

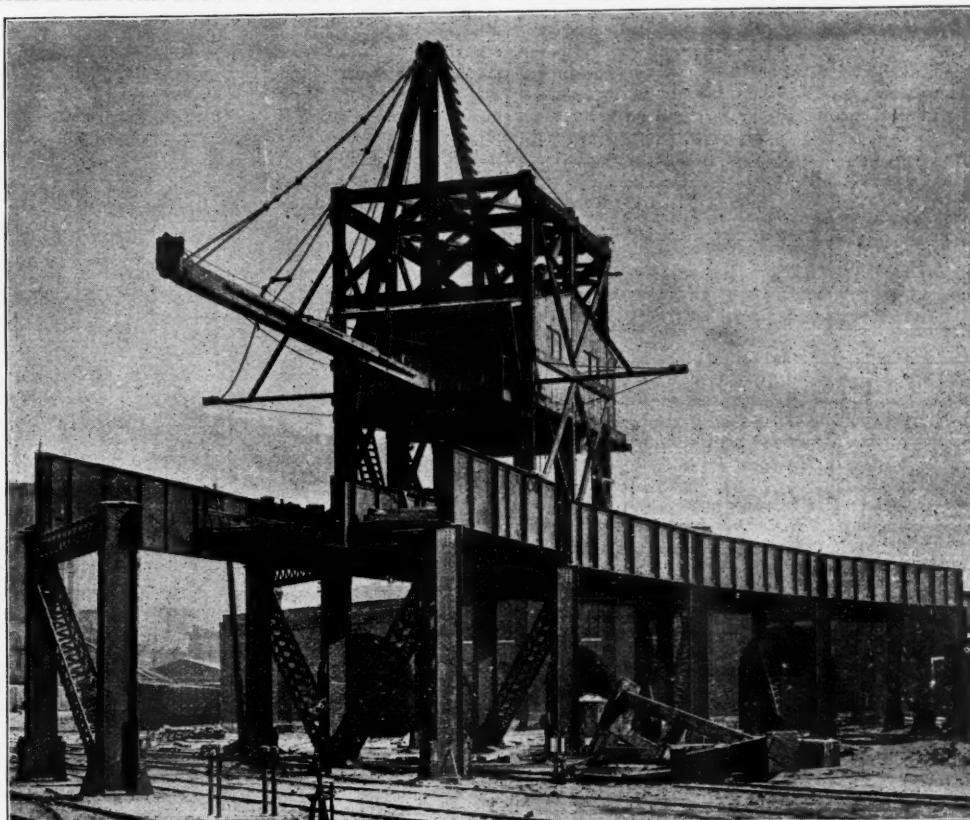
Ohio Railroad Commissioner's Report.

Mr. William Kirby, Commissioner of Railroads and Telegraphs for the State of Ohio, has issued the 27th annual report of his office. The length of railroad in Ohio June 30, 1894, was 8,738 miles, an increase of 95 miles over the preceding year. The statistics of traffic, income, etc., purport to be given for lines and operations within the State of Ohio; but how these sums have been separated from the operations of the respective roads which were carried on in two or more states does not appear. The gross earnings per mile of road are given as \$6,883, as compared with \$9,639 for 1893, a decrease of \$2,748, or 28.5 per cent. One passenger, 107 employees and 335 other persons were killed on railroads during the year. Of the latter number 233 were walking on or across tracks and 52 were trespassers on trains. Abstracts of the Inspector's notes, made on 23 different roads, are printed in the report. The question of abolishing dangerous grade crossings at highways has been under advisement at many places during the year, but the Commissioner does not report any definite results as yet. The Cleveland, Cincinnati, Chicago & St. Louis adopted Pintsch gas for passenger cars during the year. All roads have reported on the kind and gravity of oils used for signal (?) lights, and it is all of the legal fire test. The official reports made by the railroads since 1867 have been bound in volumes and indexed. In April, 1894, the power of the Commissioner was increased by a law giving him police supervision in relation to the safety of persons and property, and by the same law the railroads were assessed a tax on their gross earnings to maintain the Commissioner's department. The law now requires all structures and wires above and across railroad tracks to be approved by the Commissioner. The report contains a large map of the state, showing the principal railroads in distinctive colors. It appears to be a new one, though it bears no copyright date.

The report proper takes only 24 pages, but the volume is filled out by a list of telegraph officers in the state, list of

officers of railroads in great detail and tables made up somewhat after the fashion of those in the report of the Statistician to the Interstate Commerce Commission. Some of these tables would seem to be of doubtful value

which is 33.53 miles to every 10,000 inhabitants, and 13 miles to every 100 sq. miles of territory. Statistics are given, as usual, of rails, ties, bridges, etc. About three miles of trestle has been filled in with earthwork. The



Elevated Structure of the St. Louis Terminal Association.

to the public, as, for instance, 45 pages showing the number of days worked by different classes of employees on different roads, with the total yearly and average daily compensation.

Michigan Railroad Commissioner's Report.

The Railroad Commissioner of Michigan, Simeon R. Billings, has issued the twenty-second annual report of his office. The statistics are more than a year old, being to Dec. 31, 1893. The opening part of the report refers, however, to the events of 1894. It is said that during the coal famine wood was burned in many locomotives. Aside from this and the Chicago strike, which spread into Michigan, the roads have had favorable conditions, and not a passenger was killed during the year ending Dec. 1, 1894, which is in pleasing contrast to the record of the previous year, when 46 were killed. This state, it will be remembered, was the scene of two of the worst collisions incident to the World's Fair extra traffic.

Notwithstanding the general shrinkage in business the Commissioner is pleased to state, after close observation, that the railroad property of the state, as a whole, has not been neglected. The Commissioner names three roads whose bridges or other works he was obliged to criticize somewhat severely.

The length of railroad in Michigan is 7,572 miles

bridges in the state, including 35 new wooden and 30 new iron or stone, aggregate as follows:

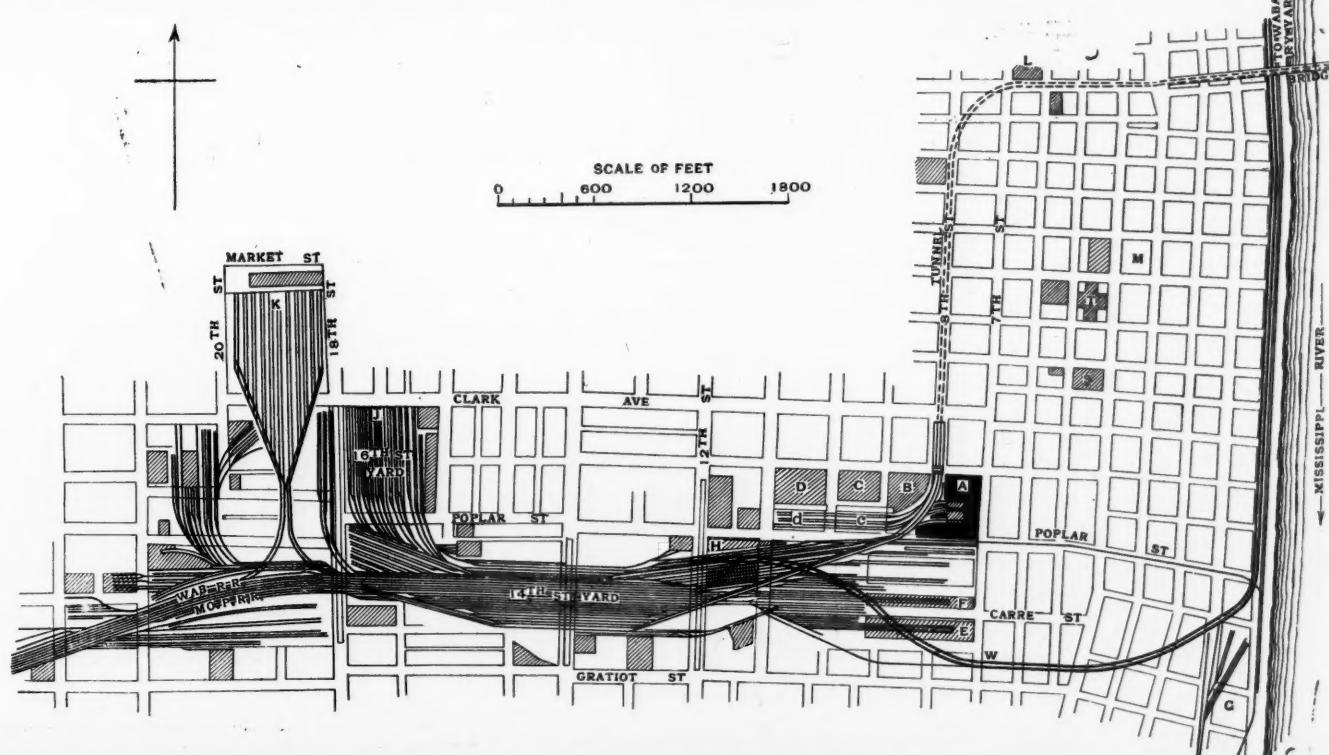
	Length in ft.
Wood.....	47,419
Stone or iron.....	30,686
Combination.....	11,622
Trestles.....	261,218
Drawbridges.....	4,232
Total.....	355,27

The number of trestles has decreased by 178. Of highway crossings there are 7,664, of which 7,449 are at grade; 510 of the latter are protected by flagmen, gates or automatic signals. This last figure was reported too large in previous years.

Forty-six passengers, 58 employees and 96 other persons were killed, and 127 passengers, 362 employees and 77 other persons were injured during the year.

The taxes of the railroads in Michigan for the year were \$811,057, which is 9.25 per cent. less than for the preceding year.

The appendix contains a report from E. F. Moore, Mechanical Engineer of the department. He has examined the bridges of the state, but his report is exceedingly brief. There were 29 derailments in interlocked limits during eight months of 1894. After a conference with the signal officers of the leading roads in the state he has promulgated rules and specifications for use in



Route of the St. Louis Terminal Association's New Elevated Structure.

new switch and signal work. They require complete plans to be presented to the Commissioner before beginning new work. About 143 engines have not been equipped with driver brakes, as required by law. Mr. Moore finds that highway crossing alarm bells generally give poor service. The records of 36 crossings, on five railroads, for the first eight months of 1894, show that the instruments were out of service, on account of breakage or failure of mechanism, 2,805 hours, equal to 78 hours for

for the same road, also from designs of Mr. John B. Smith.

Fig. 1 is a photograph of one of these engines and tender, and Fig. 2, a photograph of the front end of the engine showing the position of the cylinders. All three cylinders are high pressure, the extra one being introduced to secure a more uniform turning moment at starting, the cranks being set 120 degrees apart. The axes of the cylinders are inclined from the horizontal, the

quality of the steam would account for the difference of percentages of water shown by the indicators.

The following table gives the principal dimensions of the locomotives:

	No. 35.	No. 3.	No. 4.
Diam. and stroke of cylinders...	17 in. \times 24 in.	20 in. \times 24 in.	18 $\frac{1}{2}$ in. \times 24 in.
Diam. of piston rods...	3 in.	3 in.	3 in.
Outside lap of valves...	$\frac{3}{8}$ in.	$\frac{3}{8}$ in.	$\frac{3}{8}$ in.
Inside lap of valves...	$\frac{1}{32}$ in.	$\frac{1}{32}$ in.	$\frac{1}{32}$ in.
Lead in full gear...	$\frac{1}{16}$ in.	$\frac{1}{16}$ in.	$\frac{1}{16}$ in.
Diam. of drivers...	57 in.	49 $\frac{1}{2}$ in.	49 $\frac{1}{2}$ in.
Weight on drivers...	110,100 lbs.	110,000 lbs.	112,350 lbs.
Total weight in working order, including tender...	202,000 lbs.	188,000 lbs.	191,650 lbs.
Diam. of boiler shell...	64 in.	61 in.	60 in.
Length of tubes...	120 in.	150 $\frac{1}{2}$ in.	134 in.
Number of tubes...	307	211	230
Diam. of tubes...	1 $\frac{1}{4}$ in.	2 in.	2 in.
Length and width of firebox...	113 $\frac{1}{2}$ in. \times 96 $\frac{1}{2}$ in.	120 in. \times 96 in.	114 in. \times 96 in.
Total heating surface...	1,600 sq. ft.	1,731 sq. ft.	1,731 sq. ft.
Length and width of steam ports...	13 $\frac{1}{2}$ in. \times 1 $\frac{1}{2}$ in.	16 in. \times 1 $\frac{1}{4}$ in.	12 $\frac{1}{2}$ in. \times 1 $\frac{1}{2}$ in.
Length and width of exhaust ports...	13 $\frac{1}{2}$ in. \times 3 in.	16 in. \times 2 $\frac{1}{4}$ in.	12 $\frac{1}{2}$ in. \times 2 $\frac{1}{4}$ in.
Travel of valve...	5 $\frac{1}{4}$ in.	5 $\frac{1}{2}$ in.	5 $\frac{1}{4}$ in.

To compare the performances of the three engines, the results are reduced to a thermal unit basis and the percentage of economy figured from the number of thermal units required per pound of train. This appears to be the most favorable way of comparing engines of different classes, as it gives due credit for the expenditure of energy.

	No. 35. Test 3.	No. 3. Test 7.	No. 4. Test 6.
Duration of test, hours...	1,166	1,166	1,166
Total water used, lbs...	21,417	20,654	29,927
Water used per hour, lbs...	18,637	18,497	18,741
Average H.P.	462.9	474.6	483.0
Average steam pressure, lbs...	156	126	141
Total heat in steam at av. press., B.T.U.	1,226.4	1,221.7	1,224.1
Temperature of feed water, degs. Fahr.	54	53	56
Pounds of steam accounted for by indicator	29.15	31.01	30.19
Percentage of steam accounted for by indicator	73.5	80	77.18
Percentage of loss due to condensation, leakage, etc.	26.5	20	22.2
Water per hour per H.P., lbs...	39.68	38.76	38.8
B.T.U. required per H.P. per hour	46,401.8	45,105	45,322
Total B.T.U. required	25,109,291	24,056,080	24,444,829
Total train weight, lbs...	1,319,960	1,550,300	1,625,190
B.T.U. per pound of train	19.02	15.52	15.06
Percentage of economy	2.96		

The following table gives the observed smoke-box vacuum on all trips:

	Engine No. 35.			Engine No. 4.			Engine No. 3.		
	Trips	Trips	Avg.	Trips	Trips	Avg.	Trips	Trips	Avg.
Highest observed vacuum in inches of water	6.25	6.50		7.50	7.75		9.00	9.00	
Lowest observation....	4.00	4.00		4.00	3.75		5.00	4.00	
Average vacuum....	5.28	5.31	5.30	5.79	5.87	5.83	8.02	8.12	8.07

Engine No. 3, although it had the highest vacuum, did not steam as well as the others. The effect of the three cylinders seems to give a smaller vacuum in the smooth box, although the other conditions are not well enough given to say that this is the true reason. A more continuous draft, however, can doubtless be secured.

each crossing. On only two crossings was the service reported as continuous for the eight months. The engineer believes that with more careful attention these machines would give much more satisfactory service.

The engineer has done a good deal of work toward enforcing compliance with the law regulating the height of electric wires on street railroads and above steam railroad crossings. He has gathered information about the size and kind of netting used in smokestacks to prevent setting fires, but does not find that anything is to be learned from a comparison of the fires set, with the kind of netting used, on the engines of any particular road.

Commissioner Billings is Chairman of the Railroad and Street Crossing Board, established in 1893, and there is a report on the crossing problem at Detroit, including the study of it made by Mr. Charles Paine.

Wisconsin Railroad Commissioner's Report.

The report of Thomas Thompson, Railroad Commissioner of Wisconsin for the fiscal years ending June 30, 1893 and 1894, has been issued. This is the sixth biennial report. This is a thinner book than the one reviewed in the foregoing article, but it appears that this is no fault of the Commissioner, for the law limits him to an expenditure of 25 cents a copy for publishing the report. The length of railroad in Wisconsin is 6,004 miles, being an increase of 219 miles during the two years. The State received from the railroads in license fees for 1894 the sum of \$1,205,999, equal to \$216 a mile of road. This is based on the gross earnings, which were \$28,318,544, as compared with \$23,263,551 in 1893. The sleeping car companies pay a tax of 4 per cent. on the earnings of their cars in Wisconsin. For 1894 this amounted to \$1,233, a slight increase over 1893. The accident record shows:

Year ending		June 30, 1893.		June 30, 1894.		
Killed.	Injured.	Killed.	Injured.	Killed.	Injured.	
Passengers.....	9	30	4	28		
Employees.....	71	368	38	177		
Trespassers.....	97	40	60	75		
Not trespassing.....	10	25	14	21		
	187	463	116	281		

All complaints received by the Commissioner were referred to the railroad companies, and by them promptly considered. All were adjusted without the interference of the law department. In the department of the book devoted to statistics there is a table giving the name and post office address of every director of every road in the State, from which it would appear that the Wisconsin granger desires to have the whereabouts of the gold bugs in the shape of "handy information," so that he can put his finger upon them whenever necessary.

Smith's Three-Cylinder Locomotive.

In the *Railroad Gazette* of Dec. 30, 1892, were published drawings and description of a 3-cylinder locomotive built for the Erie & Wyoming Valley Railroad by the Dunmore Iron & Steel Company from designs of the late John B. Smith, President of that road, and the reasons for the departure from the usual manner of building were also given. Since that time the Baldwin Locomotive Works have built three similar locomotives of the mogul type

amount of the inclination being 4 in. in 35. Another noticeable peculiarity is the absence of counterbalance in the main driving wheels, the excess weight carried by the crank axle being said to be sufficient to balance the weights on the crank pins of the wheels. The front and rear wheels are balanced for revolving parts only, no balance being put in for the reciprocating parts. An innovation also is seen in the design of the tender, a general drawing of which is given in Fig. 3.

Fig. 4 gives a detail of the crank axle, the bearing of the main rod being 9 $\frac{1}{4}$ \times 3 $\frac{1}{4}$ in. Three-quarter-inch fillets are used where the crank plate joins the axle, and $\frac{1}{4}$ in. fillets between the crank-pin and plate.

A comparative test was made in October, 1894, between engine No. 35, the 3-cylinder mogul made by the Baldwin Locomotive Works; No. 3, a 2-cylinder consolidation, and No. 4, a 3-cylinder consolidation. The run was between Avoca and West Junction, a distance of 10.2 miles with an average grade of 52.8 ft. per mile. Twenty loaded cars were hauled each trip and the records of coal



Three-Cylinder Engine at 8-in. Cut-off. Two-Cylinder Engine at 8-in. Cut-off.

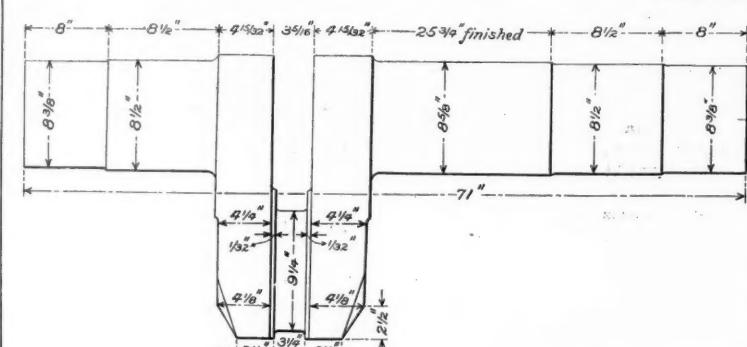


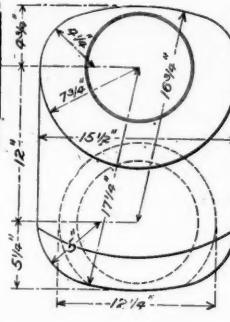
Fig. 4.—Driving Axle, Smith Three-Cylinder Locomotive.

and water were obtained by means of fuel in bags, and water meters. The conditions of rail and weather were practically the same throughout the tests.

In making up the report on the test, no account seems to have been taken of the water used by the air pump, wasted by the injector or in blowing off of the safety valve, but all the water not accounted for by the indicator seems to have been charged up to loss by condensation, etc., in the cylinders.

No calorimeter was apparently used. The steam at times in engine No. 35 was so wet as to interfere with the taking of indicator cards, while the other two engines gave comparatively dry steam. This difference of the

Fig. 5 shows the comparative rotative effects of the three-cylinder engine No. 4 and two-cylinder engine No. 3 running at an 8-in cut-off, the dotted lines being the separate crank efforts and the full line the combined effort. The difference is not so marked as it would be at shorter cut-offs and higher speeds, but the result is plainly in favor of the three-cylinder engine. This more continuous application of power and better counterbalancing seems to be the principal features in favor of the three-cylinder, the former being especially useful in the conditions under which these engines are worked, as very high speeds, at which the effect of more perfect balancing would be noticeable, are not attained.



The Relief Department of the Pennsylvania.

The ninth annual report of the Relief Department of the Pennsylvania Railroad, which is just issued, is in many respects a remarkable document, as showing the magnitude and the success of this department which may be termed a departure from ordinary business methods. It is, however, a departure the character of which is coming to be recognized as strictly consonant with the best business principles, although in its inception the Pennsylvania officers were largely actuated, no doubt, by philanthropic motives.

This department was inaugurated in 1883, and provides for contributors, at a moderate cost, certain allowances or "benefits" when they are sick or suffering from accident, and certain payments to their families or designated beneficiaries when they die. Membership is voluntary, and the number has grown from 19,952 at the close of 1886 to 33,405 on Dec. 31, 1894.

The latter number comprises more than half the employes, many of the remainder being ineligible on account of age or physical condition.

The surplus now amounts to \$273,751, but it is still insufficient for establishing a superannuation fund on a firm basis. The subject, however, is receiving the earnest attention of the Advisory Committee and of Superintendent Anderson. The death rate during the year was equal to 11.5 per thousand members, and the average number constantly disabled was equal to 32.3 per thousand.

Simultaneously with the report the company has issued a pamphlet describing the department and stating in a plain way the results of the past nine years. The sums shown to have been received and paid out strike the reader as something enormous. The revenue of the relief fund is stated as \$4,949,011. In the distribution of this in benefits men disabled by accident have received \$722,565. To the sick has been paid \$1,287,220, and the death benefits have amounted to \$420,944 for accident cases and \$1,279,215 for death from other causes. The total benefits amount to \$3,709,945.

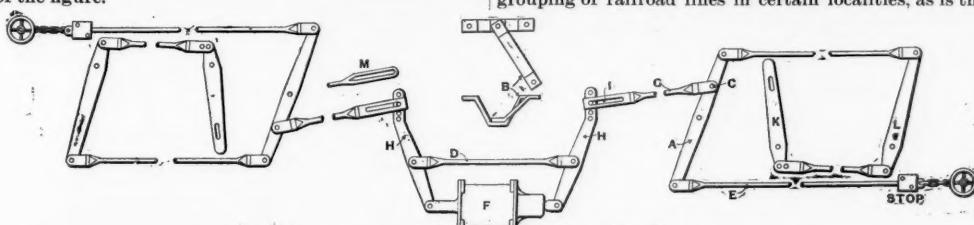
The financial statement shows that there is on hand \$195,935 subject to payments of liabilities and that there is a separate surplus fund of \$273,751, which has been set aside as a basis for a superannuation fund which it is intended to establish.

No operating expenses are paid from the fund, all these being paid by the company, which also supplies office and transportation facilities. The actual cash paid by the company for operating during nine years is stated at \$636,555, in addition to \$136,645 paid by the company through the Relief Department for aid to its members who remained sick after exhausting their title to benefits under the regulations governing the Relief Fund. The total payment for sickness has been nearly double the amount paid on account of accidents and the amounts paid for death from ordinary causes have been over three times as great as those paid for death from accident in the service. To show the moderate cost of membership in this association it is stated that a member may draw for sickness, in one year, as much as his dues would aggregate in 16 years, and that the death benefit is equal to the dues of 28 years; and the safety of the insurance is practically guaranteed by the Pennsylvania Railroad Company, with its 129 millions of capital.

The Employees' Savings Fund, which is entirely distinct from the Relief Association, now has 4,112 depositors. The amount received during 1894 was \$366,015 and the amount of money in the fund \$1,354,595.

Dickinson's Brake Rigging.

Mr. G. W. Dickinson, General Superintendent of the Northern Pacific, has applied to some passenger cars of that road a new arrangement of brake rigging, by which the air-cylinders and the hand brake-wheels can be operated simultaneously without danger or inconvenience, and a patent has been obtained upon it. The operation of these rods and levers will be understood by reference to the accompanying drawing, in which *A* represents a lever, which turns upon a fixed fulcrum at its center, instead of being a floating lever, as it is in the ordinary Hodge arrangement; the rod *I*, having a slotted end, is the connection between this lever and the main connection with the air-brake cylinder, and *H*, *H* and *D* are the main levers for equalizing the air-pressure to the separate trucks. *M* shows a side view of the slotted end *I* of the lever *G*. (The parts at the left of the drawing are duplicates of those at the right.) The bracket for supporting the rod *A* at its center is shown in the upper central part of the figure.



Northern Pacific Brake Rigging.

It will be seen that by the introduction of the loose connection at *I* the hand-brakes on the opposite ends of the car are disconnected, so that each brake-wheel controls only the truck on its own end. By introducing the fixed fulcrum at the center of the lever *A*, and by mak-

ing the power-connection through *H* and *G* to the point *C*, the application of the air, instead of pulling on the hand-brake lever *E*, as it does in the ordinary arrangement, has no effect on *E*; thus whenever the air is par-



Fig. 2.—Smith Three-Cylinder Locomotive.

tially applied the brakeman can produce additional pressure by the hand-brakes, if that be found desirable.

When cars have been placed upon a side track the brakeman can wind up the hand-brake chains and set them so as to hold the brakes on after the air shall have leaked off. By the use of the slot *I* in the end of lever *G* the brakeman is enabled to apply the brakes without wasting energy on the air-cylinder or its connections.

We understand that this arrangement has been introduced on some or all of the through passenger trains of the Northern Pacific. The road has seven mountain summits, approached by 116-ft. grades, so that it is necessary to manage the air-brakes in the most careful manner. Experience on these grades has shown that the necessary bleeding of the air-cylinders before attempting to use the hand-brake is often very inconvenient; and by this invention it is done away with.

Track Elevation in Chicago.

In considering the present status of the movement for abolition of street crossings at grade in Chicago, it is well to take a brief retrospect of the entire matter.

Twenty railroad companies own and use rights of way into the city of Chicago. Some of these companies have

estate. In some cases the new lines paralleled closely the older lines, while in others the new lines made wide circuits around the outskirts of the city before taking aim at a depot. With the increase of freight business, connecting lines and belt lines have been built from time to time, so that at the present time the location of railroads in Chicago is about as complicated as it well can be.

As the population of the city increased so also did the business of the railroads increase, until an average of upwards of 350 people per annum were killed on the tracks of railroads in the city of Chicago. The local papers took up the appalling list of railroad casualties, and urged a separation of the grades of streets and railroads. Viaducts have been built at great expense, carrying the streets over the railroads, and many other viaducts have been ordered built.

Early in 1892 the following resolution was passed by the City Council: That the Mayor be and hereby is authorized to employ three experts who shall examine the roads and construction of all steam railroads now centering in Chicago on grade crossings. That said three experts be appointed for the purpose of suggesting a remedy whereby grade crossings on all said terminal roads can be abolished by elevation or otherwise.

In accordance with the resolution Mayor Washburne appointed an ex-master mechanic, a real estate agent and an insurance agent as his Board of experts. This Board employed a bridge engineer, visited several eastern cities, and in July, 1892, made a report on the subject. In this report the Terminal Commission recommended that all railroad tracks be removed from the area bounded by Canal street on the west, Kinzie street on the north and Twenty-second street on the south, and that all other tracks be elevated sufficiently to clear all streets.

After this an ordinance was passed by the City Council requiring all steam railroads to elevate their tracks so that no part of the structure should be less than 16 ft. above the grade of the streets. In a certain district of the city this elevation was to be completed by January, 1895; in another district by January, 1897; and the whole was to be completed by Jan. 1, 1899. So far no work has been done by the railroads under the provisions of this ordinance.

It is not to be supposed that the railroad companies did not realize the seriousness of the situation. The constant and increasing expenses for maintenance of gates and watchmen at street crossings; the damage suits and verdicts for injuries and deaths; the delays and interruption of traffic caused by the numerous street crossings, all appealed to the managers for a remedy of the existing evil. The railroad officers did not make as much noise as the newspapers, but it is evident they kept up a deal of thinking.

The Illinois Central Railroad was the first one to accomplish anything in the way of track elevation. In 1892 an ordinance was passed by the Council and accepted by the railroad company, which provided for the partial elevation of their tracks south of Forty-seventh street, with a corresponding depression of the streets crossed, so as to allow bridging over the streets without excessive elevation of the tracks, which, between bridges, were carried on earth embankments. This work was completed in 1892, and as a result the Illinois Central Railroad has the finest approach to the heart of a great city that can be found on this continent.

The conditions on the Illinois Central were exception-

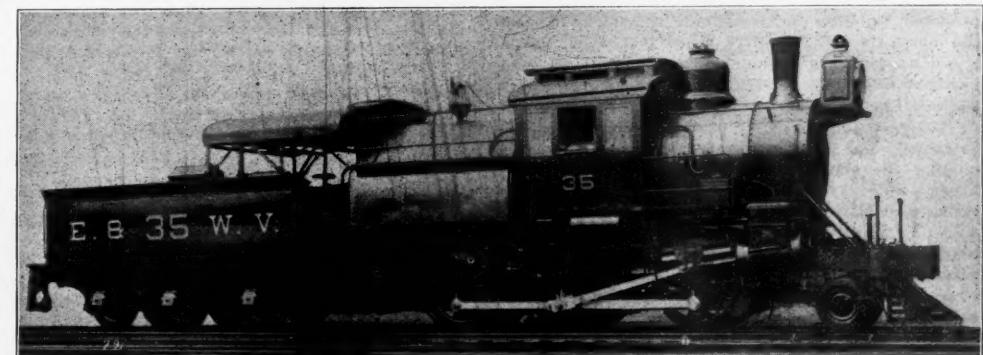


Fig. 1.—Smith Three-Cylinder Locomotive.

several divisions separating within the city limits, and the trains of other companies are run over some of the rights of way under lease or contract. As the city is a flat prairie, there are no topographical features to require grouping of railroad lines in certain localities, as is the

case in most cities, but the railroads come in from every direction. The earlier railroads of Chicago were built on reasonably direct lines within the city limits, while those roads that came in later were controlled to some extent in their choice of location by the price of real

ally favorable for abolishing grade crossings. It crossed no railroad north of Grand Crossing, nine miles out from its city terminus; for a distance of over 5½ miles it was built along the margin of Lake Michigan, with no streets to cross; hence, there were less difficulties in the way and less time was required for negotiations than would be the case with any other railroad in Chicago. The World's Columbian Exposition willingly contributed \$250,000 toward the cost of the improvement, as it took the tracks off from the surface of their grounds and rendered access to the grounds safer and more convenient. Without this track elevation it would have been impossible for the railroad to handle the millions of passengers to and from the World's Fair that it did handle.

From Seventy-second street to the old station at Randolph street there is not a single crossing of a street at grade, and no railroad crossings, so that with its eight tracks the company is enabled to operate passenger trains at high speed, freight trains at any desired speed, and frequent suburban trains, making all stops, with safety and convenience. The incline in the railroad tracks com-

mences at Forty-seventh street, the first undergraduate crossing is at Fifty-first street, and the last one at Sixty-seventh street; the foot of the incline joins the original grade of the tracks at Seventy-second street. In all there are 12 subways for streets, two for parkways, and one for foot passengers only. The total cost of this track elevation was approximately \$1,360,000, and the length of the raised track is 2½ miles.

The next companies to take active steps toward track elevation were the Lake Shore and the Rock Island. These companies own and operate jointly the line from the Van Buren Street Station to Englewood, a distance of six and one-third miles, where the tracks of the two companies diverge to the southeast and southwest respectively. An ordinance requiring the elevation of these tracks south of Sixteenth street was passed by the City Council in June, 1894. It was promptly accepted by the companies, and work was begun as soon as plans could be prepared, and continued up to late in December, when the severe winter weather put a stop to construction of masonry and raising of tracks.

At present the condition of the work is as follows: Four tracks have been raised on earth embankments to the new grade, from the crossing of the St. Charles Air Line, near Sixteenth street to Twenty-first street, thence the tracks descend on a steep temporary grade to the original surface; steel plate girder bridges with solid floors have been built over Archer avenue, Twenty-second and Twenty-third streets. These bridges are supported on abutments of masonry at the street lines and steel columns at the curb lines. It is reported that the remaining bridges will be built with a clear span from abutment to abutment, omitting the columns at the curb lines.

The entire work contemplated in the ordinance is to be completed in 1899, and it appears as if the railroad companies were carrying out the provisions of the ordinance in good faith. The ordinance requires that the elevation should continue to Englewood, where the tracks of the two roads diverge, and also on the line of the Lake Shore Railroad to a point beyond State street, and on the Rock Island to a point beyond Sixty-ninth street, about seven miles from the Van Buren street station. The ordinance does not provide for the elevation of the tracks north of the St. Charles Air Line. Here the situation is complicated by the crossing of the tracks of the Chicago & Western Indiana Railway, as well as those of the Air Line, and these, with their connecting curves, make an exceedingly difficult problem to handle.

The ordinance provides for depressing the streets at the subways, distances varying from 2 to 9.2 feet, generally not over 3 feet. There are 37 of these subway bridges required. The most difficult and expensive bridges will be those at State street, where an extensive yard is crossed on a skew, and at Wentworth avenue, where the Rock Island crosses a wide street at a very acute angle, with other streets joining the avenue close to the crossing.

The tracks of the Pittsburgh, Fort Wayne & Chicago Railway cross those of the Rock Island at grade near Sixty-third street, and as the elevation of the Rock Island tracks is to be but 10 feet, something will have to be done with the tracks of the Fort Wayne road in order to make this elevation practicable. An ordinance for the elevation of a portion of the tracks of the Fort Wayne road has been prepared, and is now in the hands of a Committee of the City Council, and will probably be reported and passed before long. This ordinance, as proposed, calls for the elevation of the tracks 12 feet at the north line of Fifty-fifth street Boulevard, the inclined approach to begin at some point in the yards north of Fifty-fifth street, the elevation to continue to the east line of State street, with an incline returning to the present grade of the tracks at some point further east. The total length of the proposed work, including the approaches, will be two and four-tenths miles. Subways beneath the tracks are to be constructed at Fifty-fifth street (this is a boulevard 200 ft. wide), Fifty-seventh street, Sixtieth street, Maple street, Sixty-first street, Chestnut street, Princeton Avenue, Sixty-second street, Wentworth avenue, Sixty-third street and State street. Some of these streets cross obliquely. The depression of the streets called for is generally between 2 ft. and 3 ft., but at Sixty-third and State Street the depression is to be 9 ft.

Viaducts now carry the streets over the tracks of the Fort Wayne road at Twelfth street, Eighteenth street and Thirty-fifth street. No satisfactory arrangements for the elevation of the tracks of this company north of Fifty-fifth street have as yet been agreed upon, but this is mainly because the Western Indiana has not agreed to carry out its part of the work. The proximity of the tracks of these two companies renders it impracticable to abolish street-grade crossings on one road without doing the same with the other road simultaneously.

The report of Colonel Ellers, Consulting Engineer on track elevation for the city, dated Nov. 19, 1894, sets forth the situation clearly. He says: "The Pittsburgh, Fort Wayne & Chicago Railway extends from the Union Station at Canal and Madison streets due south to a point near Sixtieth street, then curving to the southeast it pursues the latter direction to the Indiana State line, a distance of 14.7 miles. Between the Union Station and Twentieth street the roadbed and right of way is owned and used jointly by the Fort Wayne and the Chicago & Alton Companies, while from Twenty-first to Forty-sixth streets the right of way of the Fort Wayne joins the right of way of the Chicago & Western Indiana Railroad, the tracks of the two companies practically occupying and using the same roadbed and right of way to Forty-sixth street, immediately south of which they separate, the tracks of the Western Indiana Company curving to the west while the tracks of the Fort Wayne

Co. continue their southerly direction and finally pass into their yards at Forty-seventh street, which practically occupy the entire area between the latter street and the Fifty-fifth Street Boulevard, and between Tracy and Stewart avenues in an east and west direction. Within the present municipal limits the P., F. W. & C. Ry. owns and uses 96 miles of track, and the Chicago & Western Indiana system, which also includes the Belt Railroad, owns and operates 216 miles of track. South of Twenty-first street the tracks of the Western Indiana are used by the Wabash, Chicago & Erie, Louisville, New Albany & Chicago, Chicago & Grand Trunk, Chicago & Eastern Illinois, and the Chicago & Indiana Coal Railway companies. With the exception of the few blocks between Thirty-seventh and Forty-first streets, practically the entire distance on the west side of the right of way of the Chicago & Western Indiana Company, from Thirty-third to Fifty-fourth streets, is covered with the yard systems and tracks of the C. & E. I., the Wabash, the L. N. A. & C., and the Chicago & Erie companies, the width of the same being from 100 to 800 ft. in an east and west direction. If the hazardous character of any crossing at grade is directly proportional to the number of tracks crossed and to the number and frequency of trains, then the many highway crossings at grade on this extensive railroad system, between Twenty-first and Fifty-fifth streets must be classified as among the most dangerous in the city."

In a tabular statement he shows the number of tracks of these two companies crossing the various streets between Twenty-first and Fifty-fifth streets, this number varies from 6 to 101, none of the streets between Forty-eighth and Fifty-fourth having less than 48 tracks crossing them.

Continuing his report says: "It is manifest that the removal of the crossings at grade within such limits will require concurrent action on the part of the Pennsylvania Company and the Chicago & Western Indiana people. It will be joint work and it should be commenced at an early day. The Pennsylvania Company stand ready to go ahead with their part of the work immediately, and they have been ready to do so for more than a year past. I regret to say that it is the Western Indiana Company that is holding back. It is admitted that the peculiar character of their position makes the question one of grave moment to them, both financially and otherwise, but I doubt if the obstacles in their way are insurmountable, and believe the problem presented for their consideration capable of successful solution.

The tracks should be elevated to the maximum practicable limit, which, in my judgment, will be between 10 and 11 ft. throughout, exclusive of the terminal approaches and yard connections. . . ."

The St. Louis Extension of the St. Louis, Keokuk & Northwestern Railroad.

In the *Railroad Gazette* of Dec. 15, 1893, appeared an account of the work that was in progress for the purpose of providing an entrance into St. Louis for the lines of the Burlington west of the Mississippi River, and for the Missouri, Kansas & Texas, and for providing terminals in the city. This work was at that time in progress under Mr. George S. Morison as Chief Engineer and Mr. B. L. Crosby as Resident Engineer. In the January number of the *Journal* of the Association of Engineering Societies appears a paper under the title that we have placed at the head of this article, which is the address of Mr. Crosby as retiring President of the Engineers' Club of St. Louis. We give below some of the points of Mr. Crosby's paper, not, however, attempting to give the details at great length. A map of the line and its connections appeared with the *Railroad Gazette* of Dec. 15, 1893, and is given in the article in the *Journal*.

The total length of this line of railroad is 42 miles. It is located with maximum grades of 26.4 ft. to the mile, and maximum curves of 3 deg. The full trains hauled over

deck plate girder, the substructure being piles in cylinders, the cylinders filled with concrete. Cast-iron caps on the cylinders form seats for the girders. In order to keep the slopes of the banks away from the cylinders the girders are continuous over the piers, and overhang about 10 ft. at each end, making cantilever arms; thus the length of the girders is actually 101 ft. over all. A sketch of one of these bridges is given in Fig. 1. The single track portion of the line is now ballasted with gravel, but will be ballasted this spring with burnt clay; the rest of the line is ballasted with broken stone.

Through St. Louis County, that is, south of the crossing of the Missouri River, there was a good deal of heavy



Fig. 1.—Cantilever Plate-Girder Bridge.

work, the deepest cuts being 50 ft. The ground here was very much broken by pot holes, with no valleys that could be followed. With two exceptions all of the county roads are carried over or under the tracks. The culverts, with two exceptions, are cast-iron pipes from 24 to 48 in. in diameter. Of the two exceptions one is a 10-ft. brick barrel culvert with foundation and supporting side walls of concrete. The other, the Coldwater arch, is novel and an engraving of it is given in Fig. 2. The bed of the stream at the crossing is on solid limestone rock and on the north side is an abrupt bluff of limestone, rising about 25 ft. above the bed of the creek. It was decided to put in an arch here and carry the road over on a solid bank. The bluff was cut away enough to carry the creek through at right angles to the line of the road and an arch of 20 ft. radius was constructed, one side springing from the rock at the bottom of the creek and the other from a rough skew-back cut in the rock about 16 ft. above the true springing line of the arch. The arch is 90 ft. in length, built of hard burnt brick, laid in Portland cement, and 36 in. thick. The haunch walls are of Louisville cement concrete. The head walls at each end are brick, with stone copings.

Yards in St. Louis.—The main freight yards, which begin about two miles south of the city limits, are particularly interesting. This work was especially mentioned in our former article. About 500 acres of land is owned here by the company and at present 20 miles of track has been laid in the yard, which can be used as a gravity or poling yard. Here are a roundhouse, coal chute, freight house, oil house and warehouse. The roundhouse is built for 40 stalls, but only 30 have been built now. There is a steel turn-table 66 ft. long.

Across the northern half of the yard runs Harlem Creek, which was very devious in its course, and over which all the tracks of the yard had to be carried. It was decided to change the channel and run the creek straight to the river. Borings showed that rock for foundation could be got at from 20 to 24 ft. and above low water in the Mississippi. It was decided to build an arched culvert to carry the creek. This culvert or sewer, Mr. Crosby thinks, is larger in area than any in the country. The bench walls are 30 ft. apart and are of limestone and cement masonry backed with cement concrete. The spandrels are of concrete. The bench walls vary in height from 6 to 11 ft. The face stones average 2½ ft. deep from the face, with headers every third stone, not less than 3½ ft. deep. The top course is cut in the form of a skew-back to take the arch. These bench walls were built by the company from the Mississippi River to the western limits of the property, 1,560 ft., and have been continued by the city to connect with

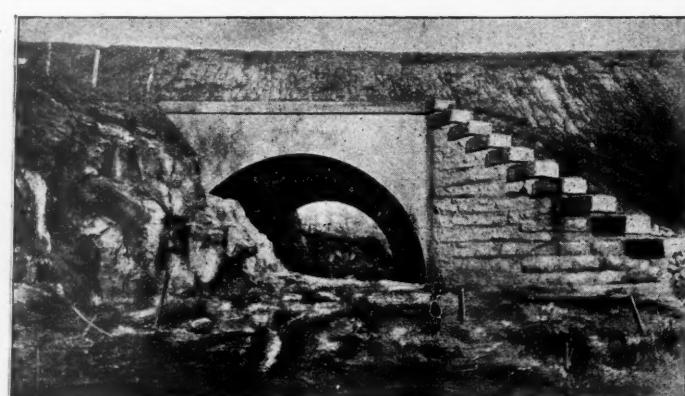


Fig. 2.—Coldwater Arch.

the old lines can be brought through to St. Louis without doubling, whereas while the entrance was by the way of the Wabash the trains hauled to St. Peter's had to be broken up into two trains before entering St. Louis. The first 24 miles of the new line, after its departure from the old line, is single track; the rest of it, into St. Louis, is double track. Two small streams are crossed by bridges which have a novel feature. These are each an 80-ft.

water-works arch over the Harlem Creek. The arch is of hard-burnt brick laid in Portland cement. It consists of seven rings, with a total thickness of 32 in. It is segmental, has 16 ft. radius and 11.43 ft. rise. The arch was turned only within the limits of the yard now built, that is, 607 ft.; but the bench walls are complete the whole length and the arch may be continued when needed. This culvert contains 6,000 cu. yds. of concrete,

2,516 of brick masonry, 2,146 of faced stone and the earth-work was 74,144 cu. yds. The total cost was \$113,616.

Further south we come to the Mound street yard, also described somewhat in our former article. This is a team track yard containing about 15 acres designed for the shipment of carload freight and has track room for about 400 cars. The tracks are laid in pairs, with driveways between, so that all are accessible by teams. These driveways are paved partly with granite, but mostly with vitrified brick. In this yard there is also a passenger station now used for the suburban trains of the Keokuk line and for all trains of the M. K. & T. The yard also has an engine house, turn-table and coal chute. It is crossed by a street bridge, being a steel span of 298 ft. This yard is a very substantial and well designed piece of work.

The brick paving, which is subject to heavy team traffic, is the first experiment of the kind in St. Louis, at least of any extent. There are 16,400 sq. yds. of it. Half of this is of one course, laid on edge on 8 in. of concrete, with an inch and a half of sand intervening. The remaining half is two courses of brick, the lower course laid flat on 2 in. of sand, the upper course on edge. There is an inch and a half of sand between the two brick courses. The pavement was thoroughly rolled with a heavy roller after laying. Then all broken and defective bricks were replaced and the pavement again rolled, interstices carefully filled with sand and a layer of half an inch of sand spread over the top to be worked in by the traffic. The ground was thoroughly rolled first, and where filling was required cinders were put in which were compacted with a heavy roller. The greatest care was used to get a good foundation. The vitrified brick was from Galesburg, Ill.

Finally we reach the freight house of the company at the southern terminus, which we have already described.

Bellefontaine Bridge.—The most important structure on the line is, of course, the Bellefontaine bridge, also described in our former article. This is double track. The four main spans are 440 ft. each, and there is a viaduct approach 850 ft. long on the north side, and beyond this a timber trestle 2,960 ft. long, which is now being filled in. This bridge has some peculiar features, and we understand that Mr. Morison is preparing a careful description of it, to be published in the form in which his report on the Memphis bridge has recently been published by John Wiley & Sons. The spans are built without any adjustable members, the top and bottom laterals being riveted and the reversal of strains at the centers of the trusses is effected by so constructing the inclined web members that they shall resist compression as well as tension, instead of using the usual adjustable counter ties. These spans are entirely of steel, except the bed plates on the piers, which are cast iron. The viaduct approach is a riveted steel structure with spans of 28 ft. 6 in. and 32 ft. 2 in. alternating. A somewhat careful description of this, with illustrations, appeared in our issue of Dec. 15, 1893.

The four piers of the bridge proper are founded on pneumatic caissons, three of which were sunk to bed rock. Mr. Crosby's paper gives drawings and description of the caissons and crib work. This foundation work was all done by the company under the direction of the resident engineer. While it was in progress there was no railroad communication with the bridge, and all material had to be brought up the river on barges, adding to the cost and being a constant source of anxiety, especially during the very low stage of water which prevailed in the fall of 1892. A large supply of coal was stored against obstruction to navigation from ice in the river. Nevertheless, there was less than 10 hours' supply of coal on hand when the track from the north reached the bridge, January, 1893. The work was really done in the wilderness, there being no town in the neighborhood.

All of the caissons, except that for pier II., were built on launching ways on the north side of the river, which were constructed by driving piles, capping them by 12 x 12 in. timber running up and down stream, and then laying the way timbers on the caps. The ways sloped 3 in. to the foot, and extended out into the river far enough to allow the caisson to float before being clear of the timbers. When the caisson for pier III. was launched it was found that sandbars had formed at its site so that there was only from 2 to 3 ft. of water, and the caisson drew 10 ft. A hole was dug on the site, however, by making fast a steamer there and setting her wheels to work. This made a depth of from 7 to 10 ft. Meantime, barges were fastened on either side of the caisson, heavy timbers being bolted across and extending out over the barges. Then the caisson was towed out into the river, and when it struck bottom the air-pumps were started and air pumped into it, raising it until it drew only about 5 ft. In this position blocking was put under the timbers that projected over the barges, and without further difficulty the caisson was towed into place, the air released and it was allowed to sink on the sand. This caisson reached bed rock at a depth of 88.8 ft. below standard low water.

The story of the caisson for pier III. gives another illustration of the difficulties of work of this sort in the Missouri River, and of the resource which an engineer who deals with that stream must have. This caisson was towed into position Sept. 24 and fastened there by lines leading to piles. At this time soundings showed 14 ft. of water at the west end and 13 at the east. The crib work was begun and continued till the 29th, when concreting commenced. At that time soundings showed 20 ft. of water all around the caisson, which was still afloat. As the caisson settled under the concrete

the current cut away the sand, and on the morning of the 30th there was an average of 23 ft. of water all around, with 25.5 at the northwest corner. That afternoon the caisson grounded on the south side; and on the morning of Oct. 1 it was still aground on the south side, but on the north side there was 25 ft. of water, with 26 at the northwest corner. About 600 bags of sand were thrown in at the up stream end to cut off the current, and on the morning of the 2d the caisson was aground on these sacks at the west end. Concreting was then continued, and on the 3d more sand bags were thrown in, along the north side, as the sand had again begun cutting out.

On the morning of the 4th the air pressure was put on. On attempting to enter the caisson through the air lock the door of the main shaft below the lock was blocked underneath and could only be opened a few inches. The pressure was let off, a man was lowered through one of the supply shafts, the top was put on the shaft and the air pressure turned on the caisson. The man below found that a part of the temporary false bottom that had been used in launching had not been removed, and that some of the timbers were jammed against the main shaft door. These he cleared, and then the caisson could be entered through the lock. Then Mr. Crosby went down and found that along the south side and the east end the caisson was filled with sand nearly to the roof, while along the north side and west end the sand was far below the cutting edge. Some of the false bottom had become wedged under the crossbeams and these crossbeams supported most of the weight of the caisson and concrete. All of them were split and most of the vertical posts between them and the roof were either shoved up into the roof or down into the beams. Concreting was stopped, men set to levelling down the sand to bring the bearing on the cutting edge all around and to clear out under the beams. When this was done a beam that had been pushed up eight inches came back to within three inches of its original position. When everything was clear the cracked beams were jacked down into place and bolted, new posts put in alongside the old ones and the work went on. Nov. 18 this caisson reached the bed rock at 101.1 ft. below standard water.

Considerable shore protection had to be provided for this work. About 2,000 ft. of the bank above the bridge was reveted with a woven willow mattress from 12 to 200 ft. in width. This was sunk and covered with riprap. Before weaving the mattress the bank was prepared with a slope of three to one, the excavation having been done by hydraulic grading, the power being furnished by a Worthington pump on a steamer. This proved a very satisfactory and economical way of doing the work. A pile dike, about 1,100 ft. long, was built, extending down past and outside of the pier on the northern shore. These piles were driven through a mattress 100 ft. wide, which extends 75 ft. outside the piles. The mattress is built in the form used by the United States Government on the Lower Mississippi, being composed of fascines of brush between frames of poles, the whole fastened together with wire. This dyke has withstood a flood which was up to the top of the stringers with the strongest current in the river running along it, "and those familiar with the Missouri River will know that without the sill mattress the piles would not have stood an hour."

Railroad Discipline.*

One of the most essential factors in the proper management of a railway, and the prompt and safe handling of passengers and traffic, is a form of discipline which shall so educate employees that a maximum efficiency for all may be obtained from minimum punishment of individuals, by making punishment of the individual secondary to the education of the entire force. Such discipline must produce results of a permanent character, and benefit alike the employee and the employer.

To deprive an employee of his means of existence seems cruel and unjust; in fact, the prevailing systems of punishment by suspension are relics of barbarism, and have been one of the causes of the growth of strife between capital and labor, and one of the most potent factors in fostering labor organizations, and, without doubt, an element in producing antagonism between the employee and the officers.

No doubt every employer has often been impressed with the one-sided records usually kept of employees; all neglects carefully noted, but no good deeds recorded. To have a true and just record there should be a system of debits and credits, so as to not only show the shortcomings of the individual, but to plainly indicate the good deeds, that every man may have the benefit of a true record of his service.

The method of discipline in use on the Indianapolis Division of the Pittsburgh, Cincinnati, Chicago & St. Louis since June 1, 1894, is a modification of the system practiced by Mr. Brown on the Fall Brook Railway. Our plan consists of the following:

1. Every neglect of duty, instruction, etc., is promptly investigated by the head of the department concerned. Most cases involve the employees of more than one department, and therefore require a joint action by two or more officers. If the case is of a trivial nature, and the facts clear, the officer or officers who make the investigation, present the facts (in writing) to the superintendent and suggest the extent of the discipline. If the examination of the offender's previous record does not show reasons for increasing or diminishing the extent of discipline, the suggestion is approved by the superintendent and a bulletin is prepared.

All cases, except those of a trivial nature, are personally investigated by the superintendent with the assistance of the head of the department in which the person is employed. If the case involves enginemen, conduct-

ors and questions of train movement or orders, the chief train dispatcher is present and assists in the examination of witnesses; also the road foreman of engines and the trainmasters. The examinations are recorded by a stenographer.

2. After a case has been investigated, discussed and the discipline decided, a bulletin is prepared under the direction of the superintendent, containing a concise summary of the facts and discipline imposed. A duplicate copy of the bulletin is forwarded to each officer in charge of a bulletin case, a copy is sent (under personal cover) to the employee disciplined, and record is made in the record book. All papers, reports, etc., of each case are filed for future reference. The record book is indexed by name; each employee has two opposite pages so that any person may examine his own record without seeing that of any other employee. The book is ruled as indicated in this sample:

No.	1894.	John Smith, Engineman.	Discipline.
112	9-29.	On Ex. West, 9-10-94, took but 17 loads from Urbana when there were 19 to go.	Reprimand.
118	9-30.	In going through Bedford Yard, 9-18-94, for his train (No. 72) ran through an open switch and struck cars on siding.	15 days.

The bulletin is a terse abstract of the record.

The form of bulletin is such as to reduce to a minimum the opportunity for employees to discover the name of the person disciplined; the object of the bulletins being to caution all who might commit a similar error. There is no advantage in advertising the names of those who receive the discipline. By furnishing each person disciplined a copy of the bulletin of their case, and by their knowledge of the record made, the effect is better than to humiliate by enabling others to know names.

After a bulletin has remained in the case 10 days, it is removed and pasted in the gummed file book. The bulletins are consecutively numbered. The file of bulletins at the headquarters of each bulletin case enables the employees to examine or study all cases.

Bulletin cases are located with the idea that they will be used exclusively by the employees of the Indianapolis Division. Whenever agents, operators, section men, shop employees and others are disciplined, a copy of the bulletin is sent each person interested, who may not have access to the bulletin case.

A summary of the advantages of the system are:

First.—To avoid loss of time and the consequent possible suffering to those who may be dependent upon the person disciplined. Loss of earnings thus prevented may mean the reform and improvement of many who would, if suspended, develop habits inconsistent with their duties.

Second.—That all may become acquainted with every case for which discipline is imposed and learn the lesson from failure of others.

Third.—The steady employment, which reduces the number of "extra men" to a minimum, and so avoids the dangers incident to the use of inexperienced persons.

Fourth.—By placing the facts before all concerned, the evils of misrepresentation are eliminated.

Fifth.—Inaccuracy of record is prevented, because any mistake will be promptly reported by those concerned.

Sixth.—The necessity for more thorough and systematic care in making investigations leads to a closer relationship between the officers and employees, a condition which produces co-operation for the best interests of the company.

The new method has involved much time and labor. Much care must be exercised in the preparation of the bulletins and record. The knowledge every employee may have of every case inspires confidence in the system.

After the new discipline had been in use five months (June to November, 1894) every employee in the train and yard service was asked to write a personal letter to the Superintendent and frankly give an opinion of the method as compared with the former practice; and of the 325 letters received, not more than 10 gave adverse opinions: these were in part due to ignorance of the old method of discipline, in part to a misunderstanding of the new system, and in part to the suspicion which some men always have of reforms.

The data obtained for the period embraced between June 1 and Nov. 1 show: Total discharged 64; of this number 45 were relieved an account of the A. R. U. strike, 4 by reason of accidents, 4 by failure to report when called, 1 for improper handling of cars, 4 for drinking, 1 for insubordination, 2 for carrying passengers without authority, and 3 for miscellaneous causes. Total number disciplined, 201. Total days' record suspensions 2,251 (not served) representing \$5,707.85 in wages saved. The total number of bulletins was 196.

During a similar period under the old method there were 230 cases.

The results during November, 1894, as compared with November, 1893, are:

Nature of Case.	Number Discharged.		Number Suspended.		Days Suspended.	
	1893.	1894.	1893.	1894.	1893.	1894.
Accidents.....	3	0	8	14	73	92
Failure to Report.....	1	0	10	5	57	56
Insubordination.....	0	0	6	1	0	10
Improper Handling of Cars.....	0	0	0	1	0	10
Unsatisfactory Service.....	7	3	0	0	0	0
Miscellaneous.....	1	0	9	3	64	27
Totals.....	12	3	27	24	194	189

Wages represented by suspension: 1893, \$508.75, actual loss; 1894, \$458.55, actual savings. The number of employees on the rolls in November, 1893, was 1657; in November, 1894, it was 1569.

Since the introduction of the new form of discipline the number of cases have decreased and the men have shown a hearty interest in keeping the number of bulletins at a minimum. The personal letters from the men have been such a source of interest that the idea is suggested to have every employee write a monthly letter to the Superintendent and give personal experience, suggestions for the improvement of the service, and ask questions upon all subjects of interest.

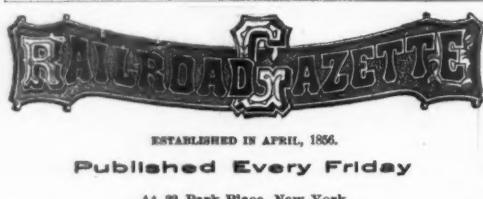
Any form of discipline which only contemplates the record of failures and neglects is incomplete, and should be supplemented by a system of "credits" for good deeds, etc. By system of record for each employee we will be enabled to judge our fellow-workers by a far better and more satisfactory standard than any method now in use. A system of "credits" based upon the many good things an employee may do, is obtained as follows:

1. A journal account, in which every case of discipline or credit is entered as decided.

2. A record, to show the debits on one side and the credits on the other—in other words, a ledger account with each employee. Credits to be in the form of days. For instance: an employee who is not disciplined during the period of a year, should have a credit of, say, fifty (50) days. One who showed loyalty during a strike

* A paper by Mr. F. G. Darlington, Superintendent of the Pittsburgh, Cincinnati, Chicago & St. Louis Railway, Indianapolis, Ind., read at the meeting of the Central Association of Railroad Officers, in Columbus, Ohio, Feb. 19, 1895.

(Continued on page 171.)



EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

In our issue of Jan. 25 appeared the text and some discussion of the proposed amendments to the Constitution of the American Society of Civil Engineers. These amendments were all carried by the letter ballot, which was canvassed last week. The one that has excited the greatest interest and the most discussion provides that ballots on reconsideration of a rejected candidate shall be signed by the voters. This amendment was passed with a smaller vote than was given to either of the other amendments, but with a large majority of the vote polled. The vote on it was 224 for and 61 against. In writing of this subject Jan. 25 we expressed the opinion that the amendment would be carried, and that for diverse reasons it was desirable that it should be. The case was by no means, however, a one-sided one, for there are good reasons for maintaining the secrecy of the ballot. But it has seemed to us that the arguments in favor of requiring the ballot, on reconsideration, to be signed are the strongest, and there are many of the most conservative and most experienced of the older members who think that it would have been a great misfortune for the Society if this amendment had not carried, in that it would have prevented the presentation for a year or two at least of many good names. In fact, a man never should be blackballed, or at least it is hard to imagine the circumstances under which he should be. His name ought not to go out for ballot if there are sufficient reasons for keeping him out of the Society. The work of the Board of Direction in scrutinizing the lists of candidates proposed is carefully and conscientiously done; it is never perfunctory; it is a work into which the time and thought and judgment of the Board are put without sparing, and it can seldom happen that a man passes to ballot if really valid evidence is presented of his unfitness. We venture to say that one of the best results, perhaps the best, of the amendment now passed, will be that nobody will hereafter be blackballed. The evidence of his unfitness will go to the Board and his name will never get further.

The Trunk line presidents have agreed to abolish all differential freight rates on April 1, which means that the Erie, the Lackawanna, the Lehigh Valley, the Baltimore & Ohio, the West Shore and the New York, Ontario & Western will raise their westbound through rates from the basis of 70 cents per 100 lbs. (first class), New York to Chicago, to 75 cents. The only reason for this action, that is given out, is that there has been an accession of virtue, good feeling and general lamb-like ness among the members of the association. To a certain extent this is probably true. The activity of some traffic officers who love to keep the rate-cutting knife constantly a-swinging, and who have seemed to do so in spite of the passive disapproval of their superiors who were more honorably disposed, appears to be slightly on the wane. But most people will wait a while before they ac-

cept this reason unreservedly. The only people who receive this news with genuine enthusiasm are the Philadelphians, who have long complained because New York shippers (having differential roads), could send freight west at rates cheaper than could be had at Philadelphia. The Pennsylvania road desired to placate these complainers and so urged the equalization of rates. How it intends to recompense its weak competitors for this concession does not appear. The sensational reporters say that the roads intend to start a regular pool. It is true that some railroad managers believe that such a course, leading to a suit in the courts to test the validity of the fifth section of the Interstate Commerce law, would be both right and expedient; but this is a question that need not be discussed just now, for a pool, if agreed upon, would not appear in definite shape for several months yet. Verbal agreements between A and B to try to see that C, D and E have a fair share of competitive business, are a kind of law-breaking that the law need not worry much about. It is more likely that the present action is an experiment looking toward an increase of through rates to the west by all lines, the strong as well as the weak. These rates are too low, as compared with freight rates over the same roads for shorter distances. Commissioner Goddard still retains the power placed in his hands a year or two ago (and which he exercised in favor of the Erie), to order changes in rates whenever he finds the distribution of the business to be unfair to any competitor; why should he not raise the rates by the strong lines in case the weaker ones complain?

The excellent discipline on the Fall Brook Railway has often been commended in the columns of the *Railroad Gazette*. Its most distinctive feature is that employees are not suspended for misconduct or negligence. This method of discipline has now been tried for several months on another and a larger road, the Pittsburgh, Cincinnati, Chicago & St. Louis, and we publish in another column of this issue an interesting account of the experience of the officers of that road in administering it. Those who think that this apparent relaxation of discipline is a "barren ideality" should note that, according to Mr. Darlington's paper, the notions of the theorists prove true in practice. There is no reason why this should not be so, and yet the slowness with which superintendents have acted on these theories of discipline has appeared to indicate that they lacked confidence in them. Moreover, the marked satisfaction reported by Mr. Darlington seems to indicate that the success of the plan is not due to local or peculiar personal factors, nor to the fact that the Fall Brook is a small road where the General Superintendent can deal more directly with the men. The essential point in Mr. Darlington's book record is that the "days" recorded against a man do not represent time lost by him; but they constitute an item which, if it is followed up by others, and the whole, added together, make up a sufficiently bad record, will lead to his discharge. The record on the book is expected to have as good a deterrent and reformatory influence on the individual as though the suspensions had been enforced. Experience thus far shows that this result has actually been accomplished. Mr. Darlington's account shows that he has taken up the matter in the right way. As has been pointed out many times, a system of this kind requires the careful personal attention of the superintendent, and involves much time and labor. He has given this attention and has not grudged the time and labor. The fact that many division superintendents are practically precluded from giving the necessary personal attention to the subject is the principal reason why we have not exhorted them oftener on this subject. Persons who are interested in discipline only as it affects the question of strikes, will note Mr. Darlington's testimony that no single thing better promotes confidence between employer and employee than a rational course, in this detail of punishment for misdemeanors and recognition of merits.

We give in another column a brief sketch of the history of the Pennsylvania Railroad Relief Department. This organization, and the somewhat similar one on the Baltimore & Ohio, have now been imitated by other roads to such an extent that no careful observer at present questions the expediency of such a means for the promotion of the welfare of railroad employees, and of friendly relations between the employees and their employers. The expediency, we mean, as a strictly business proposition. It is for the interest of any railroad, which its owners intend to make a permanent institution of, to carry out the principle here illustrated, without regard to whether the management is composed of men wholly selfish or men wholly benevolent, or those of mixed motives. It is true that only a

few roads have established relief departments, but those few are large ones; and this does not disprove the assertion that a great many railroad officers are thoroughly convinced of the value of the principle. The non-action of the great majority of companies only tends to confirm the view, suggested by other indications observable in the conduct of railroads, that railroad managements are often short-sighted. The nine years' summary presented in our sketch serves, we think, to answer in a very satisfactory manner some of the criticisms that have been made regarding this and similar organizations. It will be observed that the operating expenses paid by the railroad company have equaled about one-eighth the gross amount paid in by the members. For every \$50 paid into the general fund about \$6.40 has been expended by the company for operating expenses. As there has never been any claim that the department was not economically operated, it is fair to argue from these figures that for every 87 cents paid in, the employee gets at least \$1 worth of insurance; and this margin of 13 per cent, ought to go far to make up for inequalities of age or for the difference in degree of hazard as between different classes of employees. But the good faith of the railroad company is best shown, we think, by the additional payment from its treasury of \$136,644 in the shape of gratuities to the sick. For every \$50 paid by the employees and every \$6.40 paid by the company in fulfillment of its agreement, \$1.37 is paid, over and above all legal or moral obligations, in the shape of what may be called purely benevolent payments. It may not be practicable to make any just estimate of this last named sum on lines of strict equity, and it may even be said that the total is not large as compared with the number of members in the Association; but in spite of such considerations as these we have the fixed fact that the Pennsylvania Railroad Company has paid an average of \$15,000 a year entirely as a token of good-will to its deserving employees who have been unfortunate.

The Crystallization of Steel.

A few years ago Capt. William Metcalf, Past President, Am. Soc. C. E., who is one of the highest living authorities on steel, read before the American Society of Civil Engineers a paper on the Properties of Steel which ought to be used as a text book. In that paper he said: "It is a remarkable, and probably the most important, property of steel, that no matter what the grain may be, no matter how coarse from overheating, or how irregular from uneven heating, if it be heated uniformly to the refining heat and kept at that heat long enough, the crystals will change in size and will all become small and uniform, so that the fracture will be so even that it will be called fine-grained and amorphous; but the magnifying glass will reveal a crystalline structure in the most beautifully refined steel." To those who believe this, and probably most of us do, much of the current talk about the crystallization of steel seems a play upon words. It would be better if folks would talk about a change in the arrangement of crystals, and then those who read with little knowledge of the real texture of all steel would not look upon good steel as that without a crystal formation, and upon bad steel as that with crystals, as many mechanics now do. In truth, all solids, so far as we know, are made up of crystals, and all that can be done to change the formation is to change the arrangement and size of the crystals.

Metals that show a fibrous texture when broken, before being used, by bending or pulling slowly, without nicking, will often, when broken in service, show large crystals at the point of fracture. This has led to a theory that the strains of service produce a change in the texture, and that the metal becomes "crystallized." Again, when metals are broken before being put into service, by a quick pull or by bending after nicking, they will show the same large crystals. Now, when the metal is examined on each side of a break showing large crystals, it is found that it has a fine texture if pulled slowly or is broken without nicking. This has led to the opposing theory that the size of the crystals is dependent upon the manner of fracture and not upon the service.

But Mr. Metcalf evidently does not attach much more value to the theory that large crystals are formed at the instant of fracture than to the theory that they are developed in service. On these points he says: "We can consider now the much discussed question as to whether steel and iron crystallize in service after a long duty, and having been subjected to many repetitions of strains vibrations and shocks. If it be true that the largest, crystals and the coarsest and weakest structure are formed when iron and steel are allowed to cool slowly and in a state of rest; and if the finest crystals and the best structure can only be formed by quick cooling and the violent agitation of

the hammer or of the rolls, or by careful heating to just the right temperature to cause the formation of fine crystals, it would seem somewhat anomalous to assume that this is all reversed in the cold state, and that cold iron and steel can be shaken up into coarse crystals and a weak condition. It may be possible that such an anomaly could exist, but it seems more reasonable to suppose, when an axle or a crank-pin breaks and develops in the interior large, fiery and weak crystals, that those crystals were formed there by too much heat, too slow cooling, and too little work when the piece was formed."

Probably the most confusing of all of the common breakages is that of a chain that has seen hard service. When a new chain is pulled slowly to the breaking point it stretches considerably and the fracture is fine and fibrous, but after much service the chain will almost always break suddenly with almost no stretch and the fracture will show large crystals. If the chain after service is pulled in a pulling machine, slowly to the breaking point, it will also often show large crystals, and it is then sometimes quite brittle and will break off short when bent. But if this chain is heated to a red heat for a considerable time, and then allowed to cool slowly, it will be nearly as tough as when new and will not show the large crystals when broken slowly.

This example shows that there has been a change in the nature of the material since it was put into service, for it is weaker and brittle. This change has not been a chemical one, so far as the powers of chemistry now show, and there is much reason to believe that there has been no chemical change that is of any importance in effecting a change in the toughness and strength of the iron. But there has been a change, and it is one of "molecular arrangement." Now, this last expression seems like hiding again behind a technical expression and avoiding the question. And so it is, for a molecule is not a crystal any more than a kernel of corn is a whole ear. To say that there has been a molecular change is not necessarily to say that there has been a change of crystals, nor does a change of crystals require a change of molecules so far as we know. Crystals are made up of molecules arranged in a manner that is peculiar to almost every substance known, and by the crystals many substances are detected from an examination with a microscope, without chemical analysis. No human eye has ever seen a molecule, and probably never will, as their size, if our present theory of the structure of substances is correct, is too small to permit it.

But to get back again to the subject, it is seen that to talk of molecular change does not dispose of the discussion about crystallization, as some have tried to make us believe. We must stick to the word "crystallized" and see what can be done with it. It is pretty clear that the size of the crystals is not wholly dependent upon the work that the metal has done, or the blows it has withstood, but mostly upon the way the fracture is made, and therefore "crystallized" is not a safe word to use. It is positively untrue in most cases to say that a piece of iron or steel broke because it was crystallized when the fracture shows large crystals; yet it is true that iron and steel both experience a change in physical character when they are repeatedly strained nearly or quite up to that stress called the "elastic limit," during long periods of time. Now, this change may or may not be one of crystallization, and it is about this that the dispute has arisen, but nearly all agree that there is no important chemical change, and that there is some sort of a molecular change that has altered the character of the material.

Many have used a term that describes, not the nature of the change, but the condition in which the metal is left by the repeated strains. It is said to be "fatigued," that is, tired out and not fit to go on with its duties. The change that produces the fatigue may be molecular or chemical, or a change in the arrangement or size of the crystals. It is not now known what the change is, but it is known that repeated straining to a high degree puts metals into such a condition that they are not fit to continue in use and should be replaced, and this condition is well described by saying that it is tired out or "fatigued." We know how to avoid the fatigue of metals in most cases just as well as we should if we knew whether the fatigue was the result of a new arrangement of crystals or a molecular change.

Apparently it is enough to say that the metal has become "fatigued," and there need be no discussion as the word describes the fact exactly. It may seem that further talk about the bad use of the word "crystallization" is unnecessary, but the excuse is found in the fact that it is discussed in a recent copy of the *Proceedings* of a prominent engineering society.

An example of the bad use of the word "crystallized" is found in the report on breakages of a lot of axles by one of the best makers. The axles were made

and treated by a process to make them tougher. After about a year they commenced to break, and the fractures all showed large crystals. The breakages were all at the middle of the axles. Before being put into service the tests of sample axles showed a tough material, and they more than met the standard tests. These axles were said by some to have been "crystallized" in service, and this was accepted as an explanation of the cause of failure. This led to a wrong conception of the facts and one that is not warranted by what is known, and it has also led to a search for some way to keep the crystals small. To say that these axles were "fatigued" by repeated strains in service would be true and would mislead no one. It is common to hear that steel is unfit for axles because it crystallizes in service, and it will help to get rid of this wrong and misleading idea if proper words can be used to describe causes of failure.

Every experienced engineer knows cases where steel has been used in the roughest sort of service for long periods without fatigue, and when taken out and broken showed no change in size of crystals. The single example of locomotive parallel rods is sufficient. If steel breaks, when common sense and experience tell us that it should not, then there is a cause that can be sought out, and to drop the misleading word "crystallized" is to hasten the determination of the real cause, and, by stopping the discussion about crystallization we shall have more time and energy for useful study of the effect of repeated stresses and of the reasons why one lot of steel gives different results from another, when our common tests show them to be nearly or quite the same in quality. What is wanted is to learn first if it be true that two lots of steel, giving the same results in the preliminary tests now commonly made, do frequently give widely different results in service. If so, then the tests must be made more comprehensive so as to reach more of the multitude of characteristics of metals.

First, let us get rid of one stumbling block by dropping the word "crystallized," when speaking of metals broken in service, and substitute "fatigued," or something else that is more descriptive of the fact, and thereafter encourage all who test materials to record accurately all the physical characteristics that are now examined and report all unusual failures in service, so that in the end it may be found out whether such failures are not, after all, to be expected from the characteristics shown by the materials in the first inspection tests; this will wipe out the so-called "mysterious nature" of steel, and make it a more common and a more useful servant in the place of good hammered iron, which is now becoming more and more difficult to get.

The Association of Engineering Societies.

The Association of Engineering Societies was started in 1881 by the Boston Society of Civil Engineers, the Western Society of Engineers (Chicago), the Engineers' Club of St. Louis, and the Civil Engineers' Club of Cleveland, with an aggregate membership of 500. In 1884 the Minneapolis and St. Paul societies joined, followed in 1887 by the Engineers' Club of Kansas City, in 1888 by the Montana Society and in 1892 by the Wisconsin Polytechnic Society, which withdrew in 1894. At the close of 1894 the aggregate membership was 1,133. Since the present year opened the Denver Society of Civil Engineers, the Association of Engineers of Virginia and the Technical Society of the Pacific Coast have joined, making the present membership 1,343. Last year there was imminent danger of a break in the ranks by the withdrawal of the Western Society, but that failed when submitted to a letter ballot, by a vote of nearly two to one, and we trust that the danger has passed. The Association seems now more vigorous and more useful than ever, and from observation of its monthly *Journal*, the publication of which is almost the only work of the Association, we conclude that it is filling its place in the world more usefully than ever before in the history of the organization.

Mr. Benezette Williams was Chairman of the Board from the organization until August, 1893, when he was succeeded by Professor Johnson, elected for two years. The executive officer is the Secretary, now Mr. John C. Trautwine, Jr. In the annual report of the present Chairman especial mention is made of the efficient services of the Secretary, who receives but a very small salary, which to most men would not warrant the expenditure of much time and energy. It is obvious, however, that he has worked incessantly and with enthusiasm for the best interests of the Association, and the Chairman expresses the opinion that the editorial supervision of the *Journal* has been, under Mr. Trautwine's administration, of a higher grade than any that it has hitherto received, with which opinion we agree thoroughly.

The January number of the *Journal* contains the

annual report of the Chairman of the Board, Prof. J. B. Johnson, which gives a running history of the Association and a detailed review of the work of last year. The mailing lists show that in 1893 1,488 copies of the *Journal* were distributed, and in 1894, 1,572. These do not include specimen copies sent out or the extra copies sent to authors of papers. The *Journal* contained in 1893, 1,058 pages; in 1894 it contained 1,290, an increase of about 22 per cent. It cost in 1893 \$4,518, and in 1894 \$5,775.

An interesting table shows the number of members of the societies composing the Association, the pages of matter which they contributed to the *Journal* in the year and the pages per member. From this we discover that Boston leads, not only in membership, but in activity. It contributed per member .789 page. The society next in activity is that of St. Paul, which contributed .75 page, and Minneapolis follows with .635. The smallest amount contributed per member was from Kansas City, .385, and the average was .576. The table also shows the contributions to their own special journals, per member, of the Engineers' Club of Philadelphia, and the Engineers' Society of Western Pennsylvania, the most important of the local societies not in the Association. These societies aggregate 884 members and the Philadelphia club contributed to its proceedings .465 page per member and the Western Pennsylvania Society .516, which, it will be seen, falls considerably below the average of the Association. Apparently the intellectual stimulus of the Association is important.

The Chairman gives a history of the rise and progress of the Index department of the *Journal*, which has been practically a labor of love, and always under the immediate charge of Prof. Johnson. The board has appropriated \$175 a year for this work, and this sum has been, since the second year of the Index, paid out for assistance in the preparation of notes. The original theory was that the Index could be prepared by volunteers, and exchanges were distributed to a group of men eminently fit to make a useful and intelligent index. They were experts in the fields which they undertook to cover, and volunteered to do the work. The fact is that it was soon found that their work was good when done, but the time of getting it was very unreliable. This the Chairman does not say, but we happen to know it. Finally, one by one, these volunteers found the task too burdensome, and so the labor has devolved entirely upon the present Chairman of the Board, with such assistance as he could hire with the small sum at his disposal. Then, a few years ago the then Chairman of the Board, the Secretary and the compiler of the index undertook to collect the seven annual index summaries, consolidate and cross-reference them and publish them in book form. The results were a very valuable volume, and a net loss of money, to say nothing of time and labor; and the three benefactors of the race, who undertook the responsibility of the compilation, pocketed the loss.

The whole story is an illustration of the fact that we have seen so many times, that there is no money in publishing indexes; at any rate, indexes to the somewhat narrow field of engineering literature. The work is an extremely difficult one, simple as it may seem to one who has never tried it. It involves a considerable degree of knowledge and judgment, as well as much time and labor, and the most that the publishers can hope for is to get back the cost of manufacture, the cost of compilation being charged up to the service of mankind. We recently asked an Englishman who had written some very clever and apparently successful books, covering an important but limited field, how he could get pay for his labor. He replied that he estimated he had earned about ninepence an hour by that work. So far as we can judge the compiler of indexes must be contented with an even smaller return for his labor.

Considering these things, it is apparent that the whole profession owes a debt of gratitude to the Association of Engineering Societies and to the gentlemen who have done the index work, for the excellent index which they have published now for over 10 years, and which has by no means been replaced in quality and in value by those which are now published for business purposes.

The report of the Chairman closes with a paragraph on the matter of a suggested scheme for enlarging the province and work of the Association, as, for instance, the holding of annual conventions. His judgment is that such a step would be unwise, which we judge is sound. A considerable percentage of the members of the Association must belong to some one or more of the national societies, which already have their conventions. A convention of members of the Association would apparently be an unnecessary burden of time and money, except for those members who do not belong to the national societies; and it seems doubtful if a large attendance could be gathered, especially when we consider the

wide distribution of the membership. These societies are essentially local and as such fill a very important place in the world in bringing together the men of the same profession and supplying intellectual and moral stimulus and the machinery for concerted action which men of all occupations seem to need. They are the "town meetings" of the great body of engineers, and the "town meeting," or its equivalent, seems to have been in all ages the vital root of healthy public life. We hope, and do not doubt, that the local societies will live long and prosper, as local societies; and that the existing great national societies will go on to fill more and more completely the need for action in the wider fields, as no doubt they will.

Annual Reports.

New York & New England.—The report of this company is for the year ending December 31, 1894, and is signed by Mr. J. T. Odell, Vice-President. The principal results are as below:

	1894.	Decrease.	Decrease.
			per cent.
Gross earnings.....	\$5,175,629	\$513,381	9.0
Operating expenses.....	3,912,409	515,565	12.2
Net earnings.....	1,263,220	1,934*	0.01
Fixed charges.....	1,877,957	15.28	0.03
Net deficit.....	310,567	16.812	5.0

* Increase.

The heaviest decrease was in passenger earnings which amounted in the year to \$1,778,880, the decrease having been \$239,043 or 15 per cent. The freight earnings were \$3,211,998; the decrease \$266,065 or 8 per cent. The passenger miles were 89,492,247, the decrease from the year before having been 13 per cent. The average journey was but little shorter than in the preceding year and the average rate per passenger miles was precisely the same, namely, 1.937 cents. The ton mileage was 308,885,605, the decrease having been 4.4 per cent. The average haul was 99.37 miles, an increase of nearly 5 miles. The ton-mile rate was somewhat less, having been 1.056 cents against 1.091. Per train mile the freight earnings were considerably increased; that is, they were \$1.63 and in the preceding year they had been \$1.35. The average train load rose from 120.42 tons to 149.96. Concerning this the Vice-President says that in handling the freight traffic the summits on the main line have not controlled the load, but on the contrary the weight of the train has been based on the lower grades, with the result that the average number of freight cars hauled per train on the load basis increased 24.82 per cent. If the average of engine loads of the preceding year had been maintained, the freight train mileage would have been 2,570,967; it was actually 2,059,768, a comparative saving of 511,199 train miles, and the estimated saving is more than \$300,000. This explains how the receivers could maintain the property and make large expenditures for improvements and extraordinary repairs without decreasing the net earnings, while the gross fell off 9 per cent. The possible economy in freight transportation will grow with an increase in the long-haul business, which indicates that the future policy should be expanding the freight facilities of the road and securing through freight business.

It will be observed that the decrease in operating expenses was 12.2 per cent. or over half a million dollars. The greatest item in this saving is naturally in conducting transportation which was \$339,239 or 11.7 per cent. The saving in maintenance of way was practically nothing, that is \$6,829. The saving in maintenance of equipment was \$112,276 or 22.4 per cent. The maintenance of way item could not be reduced in spite of the extraordinary amount of work done in the year 1893. The road had not been ballasted for 11 years. The proper tie renewals had not been made for four years. So, during 1894, seventy miles of road was well ballasted, 40,000 new ties were put in, 24 miles of heavy steel was laid, and improvements were made in grades and in widening banks. Extensive repairs were necessary also on the bridges and buildings. The receivers directed that the property be maintained without any attempt to show net earnings at the expense of the property. Improvements and extraordinary repairs to the amount of \$273,000 were made. Receivers' certificates were not authorized until after the work was done, and the entire cost of this work was charged to operating expenses.

It was necessary to continue the work of rebuilding and thoroughly repairing the freight equipment which had been begun in 1893; but although 1,000 freight cars were rebuilt or generally repaired and made better than in their original state, in addition to the running repairs, it was found possible to do this extraordinary work and still reduce expenses by utilizing only one shop for general repairs, abandoning the manufacture in the company's shops of articles that could be more cheaply bought in the open market and substituting the piece work system for day work wherever it could be done. In the locomotive department 75 locomotives were rebuilt or generally overhauled in addition to the running repairs, and 15 were rebuilt by contract at the Rhode Island works. The charges for extraordinary expenditure in overhauling 1,000 freight cars amount to \$91,000, and similar extraordinary charges on the locomotive account amount to \$71,762.

The road was practically free from serious accidents and the block signal system has been established over nearly the entire length of the main line between Boston and the Hudson River.

From all this we may judge that the property has been well handled as regards operation and maintenance.

THE RAILROAD GAZETTE.

The Alabama legislature passed a bill, a few weeks ago, giving somewhat unusual rights to certain pseudo stockholders of the Alabama Great Southern, and, although the bill was vetoed by the Governor, the points raised are interesting. The bill provides, in brief, that where a foreign corporation owns the majority of the stock of a railroad in Alabama the individual stockholders of such foreign corporation may vote directly at meetings of the stockholders of the railroad. For example, the Alabama Great Southern Railway Co., of London, owns a majority of the stock of the Alabama Great Southern Railroad Co., of Alabama, and controls the policy of the road. In the natural order of things the directors of the London company, sitting at London, would send proxies to vote the shares controlled by them at the annual meeting of the railroad company in Alabama. But certain American stockholders in the English concern, desiring to exercise their rights in the railroad company more directly and with less delay, would like to vote in Alabama without going through the formality of first sending their votes (or an expression of their wishes) to London. This bill (procured by these stockholders) provided for "equitable representation," so that a minority of the stockholders in the English corporation could act in Alabama even if their fellow-stockholders were to disapprove their action. Governor Oates vetoed this bill on Feb. 15, holding that the Alabama Legislature could not rightfully interfere, in the least degree, with the right of any stockholder in the English company. He quoted a decision of the Supreme Court of Massachusetts, holding that "the corporation itself is a distinct person, and its property is legally vested in itself and not in its stockholders. As to this they cannot even by joining together unanimously convey a title or maintain an action at law for its possession or for damages done to it. The artificial person called a corporation must manage its affairs in its own way as exclusively as a natural person manages his property and business. The officers chosen by a vote of the stockholders are not their agents, but the agents of the corporation, and they are accountable to it alone." (Peabody vs. Flint, page 55.) A stockholder has no distinct ownership of the corporate property.

A lawyer in Massachusetts has given himself the satisfaction of once more testing the law which permits the placing of the condition on a reduced rate ticket, that it shall be valid only on certain trains. The case is that of the New York & New England Railroad vs. Feely, just decided by the Supreme Court. Lawyers who are not overburdened with work find congenial diversion in picayune suits against railroads, and this case seems to be one of that character. Mr. Feely boarded a train at Boston which was scheduled to stop first to Franklin, 27 miles out. He wanted to get off at Walpole, 20 miles out; he knew that the train would stop near there for a railroad crossing, and he tendered a coupon from his season ticket which was good only on trains which stopped regularly at Walpole. The company sued him for the fare through to Franklin, but recovered only 48 cents, the fare to Walpole. The court holds that Feely cannot invoke the doctrine that a passenger who by mistake takes a wrong train is not obliged to pay for his ride to the first station at which he has the opportunity to alight, for he intended to board the train as a passenger for pay, to go to the station at which he left it, and his mistake in supposing that a coupon from his season ticket would be received in payment did not render him less liable for the service he obtained. It was claimed that the conductor had accepted coupons from the season ticket for passage upon this same train, but it is held that such acceptance was a waiver of the conditions of the contract only for those rides.

The *Democrat*, of Corning, N. Y., notes the fact that the Fall Brook Railway has gone through another year with a very small accident list, and has sustained its record of never having killed a passenger. During 1894 the number carried was 448,000; none were killed and only two were injured, both of whom were intoxicated. This road does a large freight business, both northward and southward. The ton mileage per mile of line for the year ending June 30, 1894, as shown in the last report of the Interstate Commerce Commission, was 1,688,037, which is larger than that of any other single-track road in this territorial group, except the Newburgh, Dutchess & Connecticut. This is not a real exception, however, for the amount named for the latter road, 3,256,021, must be an error. It is about 100 times too large, for it would make the total ton mileage of the road 191,584,276, on which, at 3 cents per ton per mile (less than the road earned in the previous year) the earnings would be \$5,747,528, whereas the actual freight earnings, as reported, were only \$68,799.

NEW PUBLICATIONS.

Interstate Commerce Commission, Eighth Annual Report; Washington, D. C.

This report, of which advance sheets appeared last December (see *Railroad Gazette*, pages 849 and 868) has now been issued in full form by Secretary E. A. Moseley. The appendix, containing abstracts of the points decided by the Commission since its organization, has been rearranged and now appears in a more satisfactory form than heretofore. The cases seem to be arranged in chronological order and the paragraphs are like the head notes usually prefixed to legal decisions. These paragraphs are numbered and they run up to 772; and there

is a good alphabetical index to this appendix. Other appendices give the principal papers in the suit now pending in the courts against the Cincinnati, New Orleans & Texas Pacific, the statistics and information concerning government ownership of railroads in various countries of the world, which were published last August, and the other usual tables.

The *Preliminary Report on Income Account* of railroads for the year ending June 30, 1894, is treated as one of the appendices to the eighth annual report, but is not bound with the report, being issued as a separate pamphlet. The principal totals shown in this report were given in the *Railroad Gazette* of Dec. 14, page 857. They showed, in official form, the remarkable falling off in business throughout the country, which has become common knowledge by means of annual reports and other documents with which everyone is familiar. The statistics shown in this report are for only 149,559 miles of road and it is therefore necessary, as the statistician points out, to add 14 or 15 per cent. to the figures in order to make comparisons with the full totals for previous years. This applies to the statistics of passenger and freight traffic, gross earnings and expenses. A summary of net earnings and dividends is given (by geographical groups) in which comparison is made for the same roads in both years, those which reported in 1893, but have not reported in 1894, being omitted. The mileage, however, is not necessarily the same, as some of the roads may have built new lines. It is to be regretted that the statistician has not enabled us to make this accurate comparison also in the tables of traffic and of gross earnings. He has, however, in all the traffic tables reduced the passenger mileage and the ton mileage to an average per mile of line, and this comparison (for the whole country, but not for groups) is carried back six years.

The average receipts per unit are shown in the following tables.

YEARS.	AVERAGE RECEIPTS PER UNIT, SEVEN YEARS.	
	Average receipts per passenger per mile.	Average receipts per ton per mile.
1894		Cents. Cents.
1893	1.976	.866
1892	2.118	.878
1891	2.126	.898
1890	2.142	.905
1889	2.167	.911
1888	2.165	.922
1887	2.349	1.001

AVERAGE RECEIPTS PER PASSENGER AND PER TON MILE, COVERING THE SAME ROADS, 1894 AND 1893.

TERRITORY COVERED.	AVERAGE RECEIPTS PER PASSENGER AND PER TON MILE.			
	1894.	1893.	1894.	1893.
Group I.....	Cents. 1.853	Cents. 1.886	Cents. 1.247	Cents. 1.500
Group II.....	1.831	1.939	.759	.764
Group III.....	1.896	2.093	.682	.660
Group IV.....	2.371	2.397	.706	.752
Group V.....	2.319	2.373	.873	.882
Group VI.....	2.049	2.204	.942	.960
Group VII.....	2.282	2.438	1.150	1.200
Group VIII.....	2.197	2.291	1.053	1.079
Group IX.....	2.399	2.561	1.156	1.194
Group X.....	2.017	2.248	1.395	1.607

The figures for 1894 are taken, it will be remembered, from only 149,559 miles. The map showing the boundaries of the groups does not appear in the preliminary report. It is to be found in all of the full volumes of statistics issued by the Commission.

All of the foregoing refers to the introductory portion of this report. The main body of the pamphlet consists of a table, filling 35 pages, showing gross and net earnings, dividends, surplus and passenger and freight mileage for each road that has reported. These figures are given for only one year, except the net earnings and dividends, which are shown for both 1894 and 1893. The last two columns in the table, passenger mileage and ton mileage, are reduced, for each road, to an average per mile of line, so that the relative volume of traffic on different railroads can be readily compared. These items cannot be quickly compared with previous years, however, because in the report issued a year ago the gross mileage units were given, not the averages.

The statistician deserves great credit for getting out such a voluminous report, requiring such minute care, within about seven months after the end of the year. This is quicker work than has ever been done before in this line.

The January issue of the *Journal of the Association of Engineering Societies* is an uncommonly interesting one. Fifty-two pages are occupied by a joint paper on the St. Louis Water Works, in which the historical portion is by Mr. Holman; design and construction by Mr. Russell; new machinery, Mr. Laird; quality of supply, Mr. McMath, and filtration of city water supplies by Mr. Moore. Another important paper is by Mr. B. L. Crosby, past President of the Engineers' Club, of St. Louis, on the St. Louis Extension of the St. Louis, Keokuk & Northwestern Railroad. A considerable part of this paper we shall reprint. Mr. A. M. Ryan, of the Montana Society, contributes a paper on the Measuring of Water. He reports as a committee on the measurement of water for irrigation and mining, and discusses the present law and methods of measurement, and submits a form of an act, making 1 cu. ft. per second of time the unit of measurement. Another part of the contents of the *Journal*,

which will be interesting to a good many of our readers, is the annual report of the Chairman of the Board of Managers of the Association of Engineering Societies. The index to current literature appears as usual, but an experiment is begun in the economy of composition with the linotype machine, which injures somewhat the typographical appearance and convenience of the index; that is, the titles are set in capitals, and the references to publications in Roman instead of italics, making it a little more difficult to pick out the journal to which the reference is made. This, however, is perhaps largely a matter of education. At any rate, so long as the Association is willing to provide the index, and so long as the compilers are willing to put so much unpaid work into the compilation, the rest of us ought not to find any fault with it.

Transactions of the American Society of Mechanical Engineers. Vol. XV., 1894.—The 1894 volume of the *Transactions* of the American Society of Mechanical Engineers is a stout publication of 1,360 pages. It would be unnecessary to tell at much length what it contains, for our readers must by this time know pretty well what ground is covered in one year by that society. The numbered titles, which include topical discussions, reports of proceedings and memorials of dead members, aggregate 49, of which very much the greatest part is titles of separate papers. The list of illustrations covers 345 numbers. There is an alphabetical index to the volume, covering nine pages, and a very valuable table of contents and general index of the *Transactions* from Vol. I., 1880, to Vol. XV., 1894, inclusive. This occupies 152 pages.

Injectors: Their Theory, Construction and Working. By W. W. F. Pullen, Wh. Sc., Assoc. M. Inst. C.E. M. Inst. M. E. Manchester, England. The Technical Publishing Co., Limited, 1893. Crown octavo, 188 pages, with numerous illustrations and alphabetical index.

This book is intended more for technical students than as a reference book for practical engineers, since it contains mathematical work, requiring a knowledge of advanced algebra and calculus. There is a good index, but the cuts and press work are poor. The lettering on the cuts is indistinct, and the absence of chapter headings from the tops of the pages does not improve its utility as a book of reference.

The first chapter defines and explains *force* and *momentum*, and then gives a popular explanation of the action of the injector. This is followed by a mathematical deduction of the maximum flow and velocity of steam through an orifice.

Chapters II. to VIII. contain calculations for the impulse of the steam jet, size of cones, limits of working of the injector, and weight of water delivered per second; also a table giving the results of experiments, by Mr. Battolp, to determine the flow of saturated steam through a tube .275 in. in diameter and 8 in. long, and tables giving the results of the calculations. These results are also plotted in diagrams. Chapters VIII. to XII. give examples of injectors in use, mainly those in English practice with the explanation of the difference between non-lifting, lifting, automatic and restarting injectors. Chapters XII. to XVII. treat of exhaust and compound injectors, and contains calculations, numerous illustrations and results of tests. As in the previous chapters, but little is said of the practice outside of England. The remainder of the book treats of ejector condensers, a water injector, an air injector and ejector and closes with an historical summary.

Problems in Machine Design. By Charles H. Irnes, M. A. Manchester, England: The Technical Publishing Co., Limited, 1893. Crown octavo, 187 pages, with index and illustrations.

This is a book for advanced students in technical schools, and for this reason the definitions of mathematical and mechanical terms such as *force*, *stress*, etc., and the derivation of formulae are not given. There are a large number of numerical examples, solved to show the application of the formulae, by which the reader is materially assisted. This supplies a need so often felt in technical books. There is, however, a lack of definite lettering of diagrams. The cuts are poor and the press work does not do justice to the author.

Stresses in framework structures and riveted joints are taken up first, and followed by designs of cottered joints, connecting rods, piston rods, shafting, etc. Then follows an elementary chapter on expansion valve gears, and a not very valuable chapter on counterbalancing. The succeeding chapters on springs and governors are more complete and the book closes with the author's method of drawing theoretical diagrams of compound engines.

TRADE CATALOGUES.

Machine Tools. An Illustrated Catalogue and General Description of Improved Machine Tools for Working Metal; Designed and Constructed by William Sellers & Co., Incorporated; Philadelphia, 1895.

The catalogue before us deserves to be classed among the new publications rather than the trade catalogues, but as it is issued for advertising purposes it must take its place among advertising treatises. It is a substantial volume of 420 pages, bound in muslin, fully illustrated, and with 13 pages of alphabetical index. The publishers say that the earlier treatise on machine tools is out of print, and after considering the subject with the purpose of preparing a new edition it was decided to begin at the beginning, to abandon wood cuts and substitute

half-tone engravings and to rewrite the text. The catalogue is so designed as to put on the right hand pages photo-engravings of standard or special tools with brief specifications, giving sizes, etc. On the left hand pages, facing these, are general descriptions of the tools illustrated in each class, and special mention of new designs. The purpose has been to give an illustrated catalogue convenient for quick reference, together with "a general discourse for more leisurely examination." The volume has been made square, $7\frac{1}{2}$ in. \times $7\frac{1}{2}$ in., in order that the engravings may be made of adequate size and conveniently arranged.

The house was founded in 1848 and has received numerous awards at home and abroad, a short history of which is given. These include the gold medal of Paris in 1867, five medals and the grand diploma of honor at Vienna in 1873, three medals and awards at the Centennial of 1876 and the grand prize at Paris in 1889. The house did not make an exhibit of machine tools at Chicago.

We shall not attempt any detailed statement of the contents of the catalogue, which shows metal working tools of all sorts, as well as hoisting machines and cranes, injectors, shafting, pulleys, etc., and finally the Vicar's mechanical stoker.

Safety in Travel.—At last we have a thoroughly novel advertising idea. It comes from the Chesapeake & Ohio. A little book has just reached us, one of those pretty publications which the passenger departments now get out, entitled "Safety in Travel." The writer "gives himself away" very promptly by the definiteness and the assiduity with which he lugs in the scenic and other advantages of the road, and the most innocent reader can hardly fail to see that he is reading an advertisement; but the novel fact is that the pamphlet is written especially to advertise the most sensible and excellent work encouraged and done by the company, in conjunction with the Young Men's Christian Association, along the line of that road. The argument is that a man who spends his time in the houses and rooms provided by the Association, where he can have a bath and a good bed and entertaining reading and intelligent and rational companionship, is sure to be a better railroad man than if he spent his time in a bar-room. This proposition would seem to be as plain as a pike staff, but we regret to say that there are many railroad companies which still fail to show much practical appreciation of it, although there is undoubtedly a steady growth in the way of helping to provide comfortable and attractive rooms for the men at division and other important points. We are quite prepared to endorse the statement of the writer of this little volume as to the beauty of the scenery on the Chesapeake & Ohio and the excellence of the train service, and we are also prepared to endorse his theory that the sensible work of the railroad company and the Young Men's Christian Association in co-operation has raised the average standard of the service.

There is an appendix giving an annual statement of the Clifton Forge house. It seems that during the year the membership was 364 men, the number of visits to the building was 57,810 and 6,007 baths were taken. Think what an influence that was for good discipline and good manners and morals. The beds were used 4,380 times. There were regular meetings for bible class, prayer, social entertainments, lectures, etc., and among other facts it is said that there were 20 "professed conversions" and 12 attendants who joined churches during the year. We suppose that very few reasonable men have much doubt of the tremendous police value of religious influences. But, of course, in the Chesapeake & Ohio scheme, of which we have been speaking, the religious element is only a small part of the whole.

Asbestos. The H. W. Johns Manufacturing Co., 87 Maiden Lane, New York, 1895. The uses of asbestos for household articles, fabrics, fire-proof cements, packings, non-conducting coverings of all kinds, paints, fireproof roofings and construction materials, are well set forth in this little pamphlet. Numerous illustrations and good presswork make the catalogue a desirable one for reference.

Brass Pipe Plumbing. The American Tube Works, Boston, Mass., 1895.

This little book consists mostly of a collection of letters from those who have used the seamless brass tubing for plumbing work, showing the various buildings in which it has been placed and the satisfaction which it has given.

Railroad Discipline.

(Continued from page 167.)

should have a sufficient number of days credit to balance the total days discipline shown on the debit side of his account prior to the act of loyalty. If this number of days is small, the credit should be made at least 100 days. Good record on overtime, absence of accidents, absence of stock accidents, personal injuries, fires, etc., furnish an idea of the many things for which credit may be given.

While investigating the subject of discipline on the Indianapolis Division, I was surprised to find that 84 employees in train and yard service had never been disciplined during their service. The number includes only those who served longer than a year prior to Nov. 1, 1894. That this number of employees could perform the duties of their positions without discipline is a forcible demonstration of the results obtained by attention to duty.

The continued failure of an employee to obey rules, will, under any form of discipline, result in discharge;

but a method of combined debits and credits furnishes the best opportunity for employees to improve their records, and so have the benefit of an earnest endeavor to make their services valuable. The combined method proposed involves much time and study for the officers, much thought and patience with details, and a closer study of individual employees, but the result will more than repay the effort. By a system of credit bulletins there will be created an ambition which does not now exist, and the problem of increased and progressive efficiency will force its own solution through this medium.

"Discipline" and "Credit" should be so graded as to make possible a systematic routine for similar cases. The minimum discipline should be reprimand and the minimum credit should be "mention." From these starting points there may be a gradual increase to the maximum of 100 days' suspension and 100 days' credit. Discharge must be avoided whenever there is any possibility of the reformation of the individual. Disloyalty, insubordination, lying, stealing, intemperance and any conclusive evidence of incapacity should be followed by discharge, and a person discharged should not be re-employed. A strict adherence to this rule will be of much benefit. Inaugurate the combined system of credit and debit, and a newly appointed superintendent will not be hampered by the one-sided records usually kept, nor will he be dependent upon the memory of some subordinate official whose arduous duties will not admit of remembering all the good things done by every employee.

With the experience of six months, I feel warranted in the statement that the new system is much superior to any other, and produces a confidence and closer relationship between officers and employees, impossible under other forms of discipline.

Now the discipline method is established and has proved a success, I hope to add the system of credit record. * * * It must be borne in mind that one of the most essential features of good service, is the care taken to employ only such persons as will do credit to their position. This involves a thorough, systematic and searching inquiry into the past record of each applicant for any position in the service. A record of the occupation for five years preceding should be required: this to be continuous and in such detail as to furnish the means of verification. Every applicant should be required to pass a thorough physical examination, a careful examination for color sense and eye sight, and should be required to demonstrate knowledge of reading, writing and the simplest processes of arithmetic. A good education and sound physical condition form the proper foundation upon which to develop the efficient employee. Make your requirements for entering the service such as to insure the employment of only the best material, and all the trouble of such a rule will be a thousand times repaid by a progressive and permanent improvement in the force.

In concluding his paper, Mr. Darlington suggested that to establish the morale of the railroad service on a suitable foundation companies ought to have lectures at important terminals; provide reading rooms, baths, boarding houses, etc., which could be maintained at trifling cost by the members themselves if their co-operation were rightly invited; establish cheap insurance for sickness, accident and death; pension funds and savings banks. Periodical instructions and examinations should also be established in order to place the matter of promotion on a true basis of merit and ability. Wherever railroads have done any or all of these things there is a degree of contentment among the men which fully repays the outlay of money and labor. When improvements of this kind shall have been effected the question of what is a proper system of discipline will fall into a very subordinate position.

TECHNICAL.

Manufacturing and Business.

The Rochester Lamp Company, of New York City, has extended its facilities for the manufacture of the Rochester railroad station lamp, which was illustrated and described in our issue of July 27, 1894, and is now prepared to turn them out in any desired quantity.

The new power-house of the City & Suburban Railway, Baltimore, Md., on Dugan's wharf, is nearing completion. It is to be fitted with an elaborate system of coal and ash handling machinery, which will be installed by the C. W. Hunt Co., New York City. The apparatus is designed to receive coal either from vessels or cars and carry it to the top of the storage bins, which will be situated over the boilers. From these the coal is drawn into weighing and measuring shuttles, directly into automatic stokers. The same conveyor which handles the coal will take the ashes to a receiving bin from which they will be taken away by wagon.

The Craig-Reynolds Foundry Company, of Dayton, O., manufacturers of the Dayton railroad crossing gate, has recently received an order for four sets of gates from the Southern Pacific Railroad, to be erected at San Antonio, Tex. The company erected a set of Dayton gates for this company last year, and the officers of the company express much satisfaction with the operation of that gate.

The works of the Westinghouse Air Brake Company, of Wilmerding, Pa., near Pittsburgh, are now very busy, employing a much larger force than has been at work for more than a year. The works have been running for some months with about half the usual number of men, but within a few weeks past the force has been largely increased, something over 3,000 men, it is said, being employed in the shops.

The Acme Machinery Co., of Cleveland, O., reports a considerable improvement in its business, and has lately received a number of orders for bolt heading and forging machines, among them one from Nova Scotia.

The Niles Tool Works, of Hamilton, O., has recently received a large order for general machinery for shipment to Mexico, and the shops are very busy in all departments.

Bentel & Margedent, of Hamilton, O., have recently designed and built a new 12-in. universal wood-working machine suitable for heavy work in car shops.

The Harvey Steel Car & Repair Works is building two steam shovels for work on the Chicago Drainage Canal.

The Brooklyn Elevated Railroad has decided to repaint six miles of its structure, and work will commence about April 1. The road will also require a large amount of paint for station work, as it is the intention of the officers to repaint all of the old stations on the various branches of the road. The station located at Alabama avenue on the main line is going to receive a coat at once for experimental purposes as regards a selection of colors.

The Brooklyn Elevated Railroad has commenced work on apparatus for lighting its stations by electricity. Wires are now being strung from Broadway Ferry on the Broadway line and along that branch to Gates avenue. This section includes nine stations. The feed wires will be laid along the tops of the transverse girders, there being ample room between the tracks and the outer edge of the structure. The power will be supplied from South Brooklyn.

Iron and Steel.

Five angle bars, 6 x 8 in. and 100 ft. 6 in. in length, were recently rolled by the Phoenix Iron Co., at Phoenixville, Pa. These bars weighed 90 lbs. to the yard, and are the longest and heaviest ever rolled by this company.

The E. P. Allis Company, of Milwaukee, has shipped to the Quincy Mining Co., of Hancock, Mich., a steel shaft 32 ft. long, with three hubs and two cranks, weighing 60 tons. It will carry a steel hoisting drum that is 26 ft. in diameter and has a 15 ft. face. On each end of this great drum will be wound 14,000 ft. of steel cable, 1½ in. in diameter, making 28,000 ft. in all.

An order for 12,000 tons of rails for the Central Railroad of Georgia has been given to the Bethlehem Iron Co. About 1,500 men will be given employment by this order.

The steel converter and billet mill of the Joliet plant of the Illinois Steel Co. resumed operations March 4 with plenty of orders to keep it running for some time. The plate mill of the same concern at South Chicago has also started up on tank steel, but will not run on boiler grade until April 1.

New Stations and Shops.

The Berlin Iron Bridge Co., of East Berlin, Conn., has just completed a 150 ft. x 58 ft. building to be used as a power plant by the Nassau Electric Railroad Co., of Brooklyn, N. Y.

Postal Car Lighting.

In the last annual report of the General Superintendent of the Railway Mail Service for the year ending the June 30, 1894, we find the usual list of casualties to postal cars. Twenty-four cases of fire are given, seven of which, or 29 per cent. of all, were directly traceable to oil lamps used for car lighting. In five cases the fire was caused by stoves, in two by the train running into a burning bridge, and in 10 the causes are not given. There are also instances recorded where mail matter was more or less seriously damaged by oil from lamps. The authorities continue their recommendation for the removal of oil lamps and stoves from all postal cars and the substitution of compressed gas or electricity and steam heat. The superintendent says that in the year just closed gas has been placed in many additional cars, and is now in use from the Atlantic to the Pacific, the Southern Pacific having recently put it in postal cars.

The Wootten Boiler Patent.

The suit commenced in the United States Circuit Court last year by The Wharton Railroad Switch Company against the Rogers Locomotive Company for alleged infringement of Patent No. 354,370, granted to J. E. Wootten for a locomotive boiler was recently dismissed at the request of the complainant. This patent is for what is commonly known as the "Wootten boiler" and contains a single claim, in substance as follows:

"The combination, in a locomotive boiler, of a waist or shell, a firebox extended laterally beyond the waist and located in such horizontal relation thereto as to admit of driving wheels being placed beneath it. . . ."

This litigation attracted the attention of those railroad companies having boilers like those complained of in this suit; and the Rogers Locomotive Company took pains to thoroughly investigate the art and collect a large amount of evidence to support the defense, but it seems that it will not come before the Court.

An Electric Mail Carrier for Chicago.

The experiment of conveying the mail from the Chicago Post Office to the Illinois Central depot by cars running on a cable over the roofs of buildings, and propelled by an electric motor, will soon be tried. An ordinance permitting the construction of such a conveyor has been passed by the city council and the necessary right of way has been secured. The route will be from the fourth floor of the Post Office, across Dearborn street to the roof of the Temple Court building, thence east to State street, south to about 12th street, and east to the Illinois Central depot. It is expected that the mail will be delivered to the depot in five minutes by this method of conveyance, instead of taking 25 as required by the wagons.

The apparatus consists of cars running on a 3/8-in. steel cable, carried by iron brackets, attached to posts on the roofs of the buildings. The cars are cylindrical, with a conical front, and each one is large enough to contain a single mail sack. They are supported by a frame hanging from a 20-in. sheave, which runs on the cable. The grooves in the sheaves are V-shaped, so that the adhesion

to the cable is greater than could be secured by rounded grooves. These cars are detachable from the frames and open at the rear. The sheaves have ball bearings, and a sprocket wheel on the same axle is connected to a similar wheel on a motor by chain belting. This motor is fastened to the framework and furnishes the power for running the cars. The current is transmitted by a trolley running on a wire parallel to the cable. Detector buttons placed at intervals alongside the line indicate the position of the carrier, which is stopped by a brake automatically applied, when the current is shut off. The car and frame are made of aluminum, and the total weight of one empty, including the motor, is about 32 lbs. The load carried is 75 lbs. The inventor is Mr. Richard Sherman, of Chicago, who has a contract to build a similar line in Denver, from the Post Office to a sub-station.

Nicaragua Canal.

The Sundry Civil Appropriation bill, as it was sent to the President, contained a provision which authorized the President to appoint a committee consisting of an army officer, a naval officer and a third person, to be selected from private life, to make a survey of the proposed Nicaragua Canal route. Twenty thousand dollars were appropriated to defray the expenses of the commission.

Forced Draught Ventilation of Fruit Cars.

The latest use to which the airbrake apparatus of a railroad train has been put is to cool and purify the atmosphere in a carload of fruit. A car of grapes has been carried from San Francisco to New Orleans in a car thus ventilated and the condition of the fruit at destination was so good that a few boxes of the grapes were taken back to San Francisco, thus making a journey of 5,000 miles, in warm weather, and coming out in good condition. The governing valve and other appliances were designed by Rev. Dr. A. T. Perkins, of Alameda, Cal. He claims to benefit the fruit in three ways, by ventilation, by the presence of pressure above the normal atmosphere, and by sterilization of the air, which last is said to be effected by the rise in the temperature due to the compression in the airbrake pump.

Foreign Locomotive Building.

We learn from Mr. Eugen Brückmann, Engineer of the Saxony Machine Works at Chemnitz, Germany, that the dull times have passed away and they are now very busy with locomotive building. They are building 18 compounds for Russia, 16 compounds for Java, 12 compounds for Saxony, one compound for Norway, six compounds (duplex) for Saxony, besides other locomotives.

The Franklin Institute Medals.

The Committee on Science and the Arts of the Franklin Institute has recommended for the John Scott legacy medal and premium the improvement in valve trips for Corliss engines of Mr. Albert J. Bates, of Joliet, Ill. The Committee has recommended for the Elliott Cresson medal the improvements in tangential water wheels of Mr. Lester A. Pelton, of San Francisco, Cal.

Cast-Iron Rail Joints.

A new "welded" rail-joint, as it is called, has been applied recently to about three miles of street railroad track in St. Louis by the Falk Manufacturing Co., of Milwaukee, Wis. The connection between the rails consists of a mass of metal cast in heated molds in the form of a fish joint, about the abutting rail ends. In pouring, the metal is directed against the base and web of the rail, effecting, it is claimed, a fusion or weld between the iron and the steel of the rail. Joints made in St. Louis for three miles of track cover four bolt holes, weigh 120 lbs. each and cost about \$3. It requires about 12 minutes for each weld. A joint weighing only 54 lbs., placed on blocks 2 ft. apart, is said to have withstood a transverse pressure of 100,000 lbs. The work requires a plant comprising a portable cupola-furnace, a steam engine with blower attached and tanks for oil-fuel and water, all of which are carried on a four-wheeled truck. The plant weighs 7,000 lbs., and cost about \$1,000. Seventy joints have been made in one day with it. The advantages claimed for it over the electric welding are that the first cost and the cost of maintaining the plant are much less than for an electric welding machine and that the joint is stronger and better. We give this on the authority of the *Street Railway Review*, but do not look for a revolution in joints from its use.

North Chicago Power House.

The contract for the construction of the power house for the electric lines of the North Chicago Electric Street Railway Company's electric lines, at Hawthorne avenue and Division street, has been awarded to Angus & Gindale, of Chicago. It will contain engines and dynamos of 3,000 h. p., the engine room to be equipped with an overhead electric traveling crane. Work on the building will be commenced at once and pushed to completion. The foundations are already in place.

Lectures on Electricity.

A course of six public lectures on "How Electricity is Now being Utilized," by Francis B. Crocker, E. M., Ph. D., Professor of Electrical Engineering, Columbia College, will be given in Room 11, Library Building, Columbia College, New York, on successive Thursday evenings at 8.15 o'clock. These lectures will be very fully illustrated by experiments and are specially intended for professional and business men who desire to obtain an intelligent idea of the present uses of electricity. The lectures will be: "How Electricity is Generated and Stored," March 21; "Alternating Currents," March 28; "How Electricity is Used for Lighting and Heating," April 4; "The Electric Motor and its Use in Transmission of

Power," April 11; "Electric Railways," April 18; "The Telegraph and Telephone," April 25. Tickets for the course, at \$5, may be obtained of the Secretary of the President, Columbia College. Tickets will not be sold for single lectures.

Finances of the Chicago Drainage Canal.

At the last weekly session of the Chicago Drainage Canal Board the business was confined to the reception of officers' reports and minor routine business. The reports of the heads of departments showed that its salaries and office expenses for the month past amounted to \$22,553. The number of employees reported was 170, of whom 106 were in the engineering department. The report of the Treasurer, Mr. M. E. Stone, for the month of February was:

Balance on hand, Feb. 1.....	\$752,167
Receipts—Sale of bonds.....	4,000,000
Premium of the same.....	20,000
Accrued interest on the same.....	2,095
Interest on deposits.....	6,667
Total.....	\$4,780,229
Total Disbursements.....	184,646
Balance in treasury.....	\$1,595,583

The Westinghouse-Boyden Infringement Suit.

In the United States Circuit Court, at Baltimore, on the 11th inst., Judge Morris filed a decision in the infringement suit of the Westinghouse Air Brake Company against the Boyden Power Brake Company. The Boyden company was sued for infringement of the 1st, 2d and 4th claims of patent No. 360,070, issued to George Westinghouse, Jr. Judge Morris decides that the Boyden company infringes claim 2, but does not infringe claim 1 or claim 4. Claim 1 and claim 4 are specifically for construction involving the use of a supplemental emergency valve separate from the main valve, and, while the validity of claims 1 and 4 is not impeached, Judge Morris apparently holds that the emergency valve of the Boyden triple is not "independent of the main valve." Claim 2 is as follows:

"In a brake mechanism, the combination of a main air-pipe, an auxiliary reservoir, a brake cylinder and a triple valve having a piston whose preliminary traverse admits air from the auxiliary reservoir to the brake-cylinder, and which by a further traverse admits air directly from the main air-pipe to the brake-cylinder, substantially as set forth."

This claim covers every style of triple valve which has been manufactured by the Boyden company. An injunction is ordered against the Boyden company, with an accounting for damages.

Steel Work for the Boston Subway.

A contract for the steel work for the first section of the Boston Subway has been let to the Pennsylvania Steel Co. This company has made improvements at their plant which will enable it to roll the large 20 in. I beams included in the contract.

The first section of the Subway will be 2,000 ft. long and will contain about 2,000,000 lbs. of steel.

SCRAP HEAP.

Notes.

The Columbia & Port Deposit Railroad seems to have been blocked by ice, floated upon its tracks by the flood in the Susquehanna River, for about seven days, the first through train having made its passage on March 8.

Train robbers attacked an express train of the Southern Pacific near Stockton, Cal., on the night of March 8 and got into the express car, subduing the trainmen; but they failed to unlock the safe, and, finding they could get nothing, took the engine and ran ahead with it far enough to make their escape. On the same night a gang of about 50 tramps captured a freight train on the Philadelphia, Wilmington & Baltimore, near Wilmington, Del. After much delay the conductor secured police assistance and eleven of the gang were arrested. There was a dense fog which baffled the officers in pursuing the tramps.

Many people have been haunted with the suspicion that arbitration works better in the columns of newspapers than it does in real life, and New Orleans seems to be a place where the suspicion has proved true. Louisiana has established a State Board of Arbitration; but when some street railroad employees entered a complaint before the Board recently the Presidents of the street car companies at once refused to have anything to do with the Arbitration Board. When summoned to appear before it they refused to do so; later they concluded to appear, but refused to testify. After the Board had taken testimony on behalf of the employees for two or three days, the Presidents secured an injunction from the District Court prohibiting the Board from making any report or finding on the complaint of the employees.

Lake Notes.

Lake vessel men are now contracting to carry lumber the coming season at \$1.75 per 1,000 ft. from Lake Superior ports to the lower end of Lake Erie. This is a very low rate for the opening of the season. Iron ore rates are not settled, and the wheat traffic has shown little signs of life, though some tonnage is being taken from Chicago at a very low rate.

The iron ore docks at Ashtabula, which a short time ago had not less than 1,250,000 tons of ore in stock, will be cleaned off by the opening of navigation. Shipments to furnaces from all Lake Erie ports are now large.

Improvements in Illinois Central Suburban Service.

For some time past the Illinois Central Railroad has been using high platforms, similar to those on the elevated railroads, for its regular suburban service between Chicago and Kensington, and its express suburban service between Chicago and Grand Crossing. An ordinance was recently passed by the city council of Chicago

permitting the South Chicago Railroad, a double-track branch of the Illinois Central from Brookdale to South Chicago, and included in its regular suburban service, to spread its tracks where they are in the streets and to construct elevated platforms. This work is now being done, high platforms being constructed at Parkside, Bryn Mawr, South Shore, Windsor Park, Cheltenham, Eighty-third street, Eighty-seventh street and South Chicago.

These platforms are level with the car floors, 350 ft. long and 10 ft. wide, with stairs at each end, the tracks being spread so as to admit of the platforms being placed between the north-bound and south-bound tracks at the above-mentioned points. The use of these platforms enables the company to reduce the time of its stops at the various stations by one-half, on account of the rapidity with which passengers are loaded and unloaded; and to make a corresponding reduction in the schedule time of the suburban trains.

The Amsterdam Exposition.

A highly specialized exposition is to be held in the old Dutch town of Amsterdam this summer, and will probably attract many people from all over the world. The exposition will include under the general head of Hotel Equipment and Travel, all objects with which a traveler is directly connected, everything relating to his safety, convenience, entertainment or pleasure, as well as those things which are conducive to home comfort and serve to make travel more agreeable. The general classification embraces Architecture, Means of Transport, General Industry, Articles of Food, Fisheries, Health, Machinery, Lighting, Art Industry, Heating, Geography, Complete Furniture, Means of Safety, Gardening and Insurance. The awards will consist of crosses of honor and medals of gold, silver and bronze. The interests of American exhibitors at this exposition will be looked after by Mr. J. H. Gore, as Commissioner-General, who served in a similar capacity at the Antwerp exposition last year. Complete information regarding space, motive power, customs, etc., will be furnished by Mr. J. N. Kalff, 202 Monadnock Building, Chicago.

Fire in an Electric Power House.

The power house of the Chicago & North Shore Electric Railway Company at Edgewater, six miles north of Chicago, was partially burned early in the morning of March 4. The generators were uninjured and the loss was only on part of the building, one motor car and several trailers. The plant is used to operate about 12 miles of road from Graceland avenue north to Evanston.

The Delaware River Bridge.

The award of the contract for the superstructure of the Pennsylvania Railroad Company's new bridge over the Delaware river at Philadelphia will be made about March 15. The injunction granted the Philadelphia Belt Line Railroad Company has not in any way interfered with the progress of work upon the approaches.

Galveston Harbor.

The work at Galveston is reported to be so far successful that there is now 18 ft. of water on the bar. Vessels have entered and gone out drawing nearly that depth.

The Atlanta Cotton States Exposition.

Mr. Bradford L. Gilbert, Supervising Architect of the Cotton States and International Exhibition, which is to be held at Atlanta from September to December next, states that the contractors for the main buildings of the exposition are making very considerable progress with their work and that he believes all these buildings will be completed by June 1. The Government building may not be finished for a month later. Mr. Grant Wilkins, Chief of Construction of the Exposition Company, has recently designed plans for the Administration and Auditorium building. This building will be 165 ft. x 227 ft., three stories high, the auditorium portion being 100 x 227 ft., and seating over 3,500 people.

The exposition authorities expect to induce both the Pullman and Wagner Palace Car Companies to exhibit at Atlanta the trains shown by those companies at the World's Fair at Chicago. Several of the southern railroads will exhibit trains of standard passenger locomotives and cars.

Improvements on the Fireboat New York.

Mr. H. de B. Parsons has had charge of the improvements recently made in the fireboat New York. The vessel was originally equipped with a double screw, the second one joined to the first by a knuckle-joint that admitted of its being turned in a horizontal plane for the purpose of steering. This screw has been replaced with a single screw, with the result that the vessel's speed has been increased three miles an hour. The first screw was removed because it shook the vessel so that the rivets near the stern could not be kept tight.

English Railroads in the Last Half Year.

In reviewing the results obtained by our leading railroad companies in the last six months of 1894 unusual difficulties of comparison present themselves, owing to the disorganization created in the corresponding period of 1893 by the great coal strike. A comparison with a more normal period is obtained by going back to the last half of 1892, but even in that case, the change in conditions, in the course of two years, is so great, that it is misleading to draw very minute conclusions. Looked at broadly, from the shareholder's standpoint, the results obtained in the half year cannot be regarded as satisfactory, since the average dividend on the ordinary stocks of the 15 companies included in our survey was lower than in any corresponding half year of which we have a record, excepting, of course, the disastrous six months ending December, 1893. For the whole year also the average dividend is lower than for many years past, with some exception, though it is only a fraction below that for 1892. The comparison of average dividends (per cent.) for seven years past is as follows:

	1894.	1893.	1892.	1891.	1890.	1889.	1888.
First half year.....	4 1/2	3 1/2	3 3/4	4 1/2	4 1/2	4 1/2	4
Second half year.....	5 5/8	4 7/8	5 3/8	6 1/8	6 1/4	6 1/4	5 3/8
Average for whole year.....	4 3/4	4 1/2	4 7/8	5 3/8	5 3/4	5 3/2	4 1/8

The diminution in average dividend, compared with the second half of 1892, was due not so much to a falling off in receipts as to growth in working expenses and augmentation of capital. The additions to capital during the past year have been mainly in the form of ordinary stock, the growth of pre-ordinary charges having been comparatively slight.—*The Economist*.

Soo and Suez Canal Traffic.

Consul-General Penfield, stationed in Egypt, reports that 3,352 vessels passed through the Suez Canal last year. The net registered tonnage was 8,039,105, and the tolls collected amounted to \$14,770,081. Our readers will remember that 13,110,366 tons passed through the lock of the St. Mary's Falls Canal during the 234 days the lock was not closed by ice. These two waterways take the first rank among artificial channels, and the net registered

tonnage using them for the past five years is given below, with the freight tonnage of the Erie Canal for the same time as a matter of comparison.

CANAL TONNAGES.		
Year.	Net Registered.	Freight Tonnage.
1890.....	8,454,435	6,890,014
1891.....	8,400,685	8,098,770
1892.....	10,617,203	7,712,028
1893.....	9,419,714	7,659,068
1894.....	13,110,366	8,039,105

Consul-General Penfield calls attention to the sad fact that of the 3,352 vessels passing through the Suez canal no mercantile ship carried the American flag. On the other hand, about 95 per cent. of the vessels passing the "Soo" did carry the American flag. So that averaging the tonnage of the two routes, the United States vessels have an excess of some 4,000,000 tons.

The lock at the Soo never passed 2,000,000 tons until 1881, the year the available depth was increased by the new lock from 11 1/2 ft. to 16 ft. That year 4,136,770 tons passed through the Suez Canal, which was 26 ft. deep. Since that the aggregate tonnages have been: For the Suez, 57,051,610, and for the St. Mary's Falls canal, 82,476,150 tons. The tonnage of the Suez Canal was at its maximum in 1891, of the canal at the Soo last year. The Erie Canal did its maximum amount of business, 3,840,513 tons of freight, in 1887; though there was over 3,500,000 tons carried in each of the three years, 1871-73. Neither of the other canals are likely to decay in absolute usefulness, as one is owned by the general government that is building a lock 100 ft. x 800 ft. to accommodate vessels of 20 ft. draft, and the other is owned by a company that will enlarge its prism to meet the demands of commerce.

A Suggestion for the English Light Railroaders.

Some time ago the citizens of Avon Park and Haines City, Fla., believed that a transportation route connecting them would be of great advantage. The country is sandy and nearly level. A company was formed, but the people lacked in capital what they made up in enterprise. It has been decided to build the road with wood rails, which are large enough to be laid so that they will be half imbedded in the sand, without other ballast. They are to be held in position by wooden pins, two in. in diameter and 18 in. long, while the ends are connected by plank couplers placed underneath and held by pins. Not a pound of metal will be used in construction of the track, although the line will be 40 miles long. Most of the "rails" will be furnished gratis by property-owners along the right of way. The company believes that in a few years the fruit, vegetable and passenger business over the route will pay for regular steel rails, when the others will be used for ties. A small steam dummy will furnish power for the Avon Park & Haines City road.—*The Manufacturer's Record*.

Classification of Patents.

The United States Senate committee on appropriation has reported an amendment, which authorizes a division in the classification of patents in the Patent Office. The allowance for this purpose is \$44,020. It is argued that a classification by principle, as well as by uses, will protect patentees, by reducing the chances of interference.

LOCOMOTIVE BUILDING.

The Concord & Montreal has ordered three locomotives from the Baldwin Locomotive Works and two from the Schenectady Locomotive Works. The order includes passenger and freight locomotives.

The Pittsburgh & Lake Erie has recently placed an order for six 10-wheeled freight engines with the Pitts Loco motive & Car Works.

CAR BUILDING.

The Denver & Rio Grande Railroad, reported in the market for 1,000 freight cars, will not order any new equipment at present. Probably an order for new cars will be given out in a few months, but that is a matter which has not yet come up for final decision.

The Memphis Car & Foundry Co., of Memphis, Tenn., has just delivered 16 tank cars to Farrell & Co., of Omaha, Neb. The company has a conditional order of 15 more from the same firm.

The Delaware, Lackawanna & Western contract for 500 freight cars has gone to the Jackson & Woodin Manufacturing Co.

The Standard Oil Co. is building 100 tank cars at its shops.

The Duluth, Mississippi River & Northern Railroad expects to place an order for one combination car and one passenger coach.

The Baltimore, Chesapeake & Atlantic will soon let an order for new cars for a complete train to be used in the summer traffic between Baltimore and Ocean City, Md. The equipment is to be first class in every respect.

BRIDGE BUILDING.

Belair, Md.—The Harford County commissioners have been asked to construct a bridge over Foster's branch, on the road leading from Magnolia to the Little Gunpowder River.

Ft. Wayne, Ind.—The Board of Commissioners at Ft. Wayne has decided to construct a new bridge across the St. Mary's River. The estimated cost of the proposed bridge is \$11,000.

Newburn, N. C.—The bill introduced in the North Carolina Legislature to authorize the county of Craven to levy a special tax to build an iron and steel bridge across the Neuse and Trent rivers at Newburn, as alluded to in the *Railroad Gazette* last week, has passed both branches of the Legislature, and the bridge will be built.

Niles, O.—The Wrought Iron Bridge Co., Canton, O., will erect a bridge over the Mosquito Creek, at Niles, O.

Philadelphia.—Bids have been asked by the Pennsylvania Railroad Co. for the construction of the steel work for the new Delaware River bridge. There has been much opposition to the construction of this bridge by the Trades League of Philadelphia, upon the ground that navigation at this point in the Delaware will be seriously impeded.

Richmond, Va.—Proposals will be received by A. W. Hawkins, Chief Engineer of the Northern Neck Railroad, for building a steel bridge, 750 ft. long, at Richmond, Va. The bridge will have two standard gage tracks. He is also receiving proposals for girder plate bridges.

Saginaw, Mich.—The directors of the Union Street Railway Co., the Consolidated Street Railway, and the

Inter-Urban Company on March 2 discussed and partially agreed upon plans for a bridge at Bristol street. This will be an iron bridge, with a 150 ft. swing span, to cost about \$40,000. Work will be begun as soon as practicable this spring.

Toronto, Ont.—The bid of the Central Bridge Co., of Peterboro, Ont., of \$3,660 for the construction of the bridge in Island Park, Toronto, has been recommended for acceptance by the City Engineer, to whom the various bids had been referred for examination. The bridge will be built of steel, after the city designs.

Waseca County, Minn.—A bill has been introduced in the Minnesota Legislature to appropriate \$800 for a bridge across the Le Seuer River, in Waseca County.

Watowan River, Minn.—A bill has been introduced in the Minnesota Legislature to appropriate \$1,000 to aid in the construction of a bridge across the Watowan River.

Williamsport, Md.—The old project for a bridge across the Potomac River at Williamsport to a town in Berkeley County, West Virginia, has again been taken up and a local committee is now attempting to raise subscriptions of \$30,000 to the capital stock of the proposed bridge company.

Winona County, Minn.—A bill has been introduced in the Minnesota Legislature to appropriate \$1,000 to build a bridge across Whitewater River, in Winona County, and to appropriate \$800 to build a bridge across Pine Creek, in the same county.

Yonkers, N. Y.—A bridge is to be built over Troublesome Brook on the Scarsdale Road, and proposals for the same will be received until March 25, by John Pagan, Jr., City Clerk.

RAILROAD LAW—NOTES OF DECISIONS.

Carriage of Goods and Injuries to Property.

In Illinois the Supreme Court rules that under the statute which gives a right of action against railroad companies for "unjust discrimination" between shippers, the mere fact that a railroad company charges one person more than another for carrying coal from the same place, is not conclusive evidence of unjust discrimination, where it is shown that there is a difference in the coal, and in the method of handling it.

In Texas it is held that a railroad is liable for injury to stock upon its track, although its right of way is fenced, where the injury could have been avoided by the use of ordinary care on the part of its servants.¹

In Texas it is ruled that a railroad is liable for the statutory penalty for failure to deliver freight, when the consignee tenders the charges due, calculated on the charge per 100 pounds as stated in the bill of lading, and the "approximate weight" of the shipment as there stated, though this be much less than the real weight.²

In Texas it is held that when a railroad delivers stock received for shipment to a stock yards company, in whose hands it escapes, the shipper is not bound to attempt to recover it, nor to receive it, after recovery by the stock yards company, burdened with charges for feed, etc.³

In the same state it is held that where, by the conduct of an agent of a railroad, a shipper is induced to believe that his claim for damages to goods will be paid without suit, and for that reason suit is not brought within the time prescribed in the contract of shipment, it may be brought thereafter.⁴

The Supreme Court of Wisconsin holds that a stipulation, in a contract for the shipment of live stock, that the carrier shall not be liable for injuries to the stock, though caused by the negligence of its servants, is void, and hence does not prevent liability on the part of the company for injury to the stock, caused by the refusal of the train servants to allow the person in charge of the stock an opportunity to feed and water them for the space of 34 hours.⁵

Injuries to Passengers, Employees and Strangers.

In Massachusetts it is held that a person in possession of a ticket, who, while running from the street, across the company's tracks, outside the passenger station, apparently to catch a train about to start, is struck and killed by another train, has not become a passenger.⁶

In a case in the Federal Court the plaintiff, traveling on a cattle train with his cattle, with the acquiescence of the train hands, climbed on top of a car. The car was run into by another train, whereby plaintiff received injuries. Plaintiff and other cattle men had before ridden on top of cars, with the consent of the train hands, but such riding was prohibited by order of the company. He testified that he knew it was a dangerous place to ride. The court holds that the question of contributory negligence was one for the jury, and there was no error in refusing to direct a verdict for defendants.⁷

In West Virginia it is ruled that, where a passenger is riding on the platform of the car in such a state of intoxication as to be heedless of the danger to which he is exposed, it is the duty of the conductor, who has notice of his condition and danger, to use the ordinary precautions for his safety, such as calling his attention to the danger and the rules of the company forbidding such exposure, and inviting him to go inside of the car.⁸

In Texas, in an action against a railroad company for personal injuries received while a passenger on defendant's freight train, there was evidence that plaintiff was ordered out of the caboose, and with defendant's knowledge was riding on a buggy on a flat car, and that the train was derailed on account of the negligence of defendant's employees, seriously injuring him. The Supreme Court rules that a verdict for plaintiff was supported by the evidence.⁹

The Supreme Court of Ohio holds that under the statute defining the relation of railroad employees, which provides that "every person in the employ of such company having charge or control of employees in any separate branch or department, shall be held to be the superior and not fellow servant of employees in any other branch or department, who have no power to direct or control in the branch or department in which they are employed," the engineer of one train is not a fellow servant of a brakeman on another train of the same company.¹⁰

In the Federal Court it is ruled that a railroad employee, who, when engaged in removing a wrecked train, goes upon a bridge, the defects of which are patent, assumes the risk arising from such defects.¹¹

In New York, while plaintiff, an inspector employed by a palace-car company, was examining an automatic coupler, his hand was caught therein, and, before he could extricate it, was crushed by a car of defendant railroad company, which was making up a train consisting, in part, of the palace cars. Plaintiff gave evidence that defendant's employees were warned of the danger, and such employees testified that, if they had known of plaintiff's inability to escape, they could easily have prevented the injury. The Court holds that the evidence did not necessarily show that defendant's servants willfully and maliciously injured plaintiff.¹²

In Indiana, plaintiff, a superintendent of bridges and assistant superintendent of construction for defendant

had just inspected a line, half tied, in process of construction, and in the course of his employment rode over it on a construction train of which he had control, which was wrecked and he injured. The Supreme Court holds that a derailment caused by bad loading, bad track, excessive speed, or all together, gave him no ground of action against the company.¹⁴

In West Virginia in an action against a railroad for the death of a brakeman, it appeared that it was the duty of decedent, with his fellow trainmen, to observe all train signals; that while decedent's train was on a siding, a section of a train passed carrying a signal that another section was following; that this signal was not observed by decedent and his fellows, and decedent was killed in the accident which resulted. The Supreme Court holds that, because of decedent's failure to observe the signal, plaintiff could not recover.¹⁵

In Wisconsin an action for personal injuries by a motorman against an electric street railroad company, it appears that it was his duty to clean the commutator of the motor, frequently, while the car was in motion; that he was 24 years old; that he was instructed eight days in his duties before entering into defendant's employ as such motorman; that three days afterwards he was injured while cleaning the commutator; and that the danger of injury while cleaning it was obvious to any person of ordinary intelligence. The Supreme Court rules that it was one of the risks of employment assumed by plaintiff.¹⁶

In Minnesota, in an action by an employee for personal injury, the evidence showed that the injury was due to the break in a jackscrew; that the break had begun before the jackscrew was given plaintiff to use; that the defect would have been discovered on reasonable inspection, and that no such inspection was made. The Supreme Court rules sufficient to support a verdict for plaintiff.¹⁷

In New York it is ruled that it is not, as a matter of law, negligence for a person crossing a railroad track at a place where the track cannot be seen, except when one is only a few feet distant, to attempt to drive across without first walking on the track and looking for a train.¹⁸

In Pennsylvania it is held that though flagman may have signaled persons in a carriage to advance over the crossing, yet on discovering a train almost on the crossing, and the carriage coming in disregard of it, he is not negligent in stopping the horse by any means in his power, even if in doing so he frightens the horse—a thing which, with cooler judgment, he might have avoided.¹⁹

In Rhode Island the Supreme Court rules that a passenger in a sleigh struck by a train at a crossing, who did not know of the immediate proximity of the crossing, and did not hear, though he was listening, the signals of the approaching train, was not necessarily guilty of contributory negligence in failing to request the driver to stop, look, and listen for approaching trains.²⁰

In Indiana it is ruled that it was negligence for a railroad to occupy a street crossing with a train for 15 minutes, to the exclusion of public travel, and then, after the engineer had left his post, to start the train without warning persons who had been waiting in the rain for a chance to cross, including school children, who had long been permitted to pass through standing trains at that point.²¹

In Missouri, in an action for personal injuries received on a walk leading to the depot, and caused by the sudden pushing together of cars that stood on each side of the walk, the evidence showed that for 20 years defendant knowingly permitted the public to use such crossing without protest; that it constructed the walk between its rails; that it kept a space open between the cars, right over the walk, for public travel; that more people used such crossing than any other in the city; that its agent and others used the crossing the same evening, and just before plaintiff was hurt; and that, when plaintiff approached it, he stopped, listened, heard nothing and passed between the cars, which suddenly came together, crushing his leg. The Supreme Court holds that a judgment for plaintiff should not be disturbed.²²

¹ Savitz v. O. & M., 37 N. E. Rep. 235.
² A. & N. W. v. Saunders, 26 S. W. Rep. 128.
³ St. L. S. W. v. Carden, 26 S. W. Rep. 474.
⁴ G. C. & S. F. v. Eddins, 26 S. W. Rep. 161.
⁵ G. H. & S. A. v. Kelley, 26 S. W. Rep. 470.
⁶ Abrams v. M. L. S. & W., 58 N. W. Rep. 780.
⁷ Webster v. Fitchburg, 37 N. E. Rep. 165.
⁸ N. O. & N. E. v. Thomas, 60 Fed. Rep. 379.
⁹ Fisher v. W. Va. & P., 19 S. E. Rep. 578.
¹⁰ Mex. Cent. v. Lauricella, 25 S. W. Rep. 301.
¹¹ Cln. H. & D. v. Margrat, 37 N. E. Rep. 11.
¹² McGrath v. T. & P., 60 Fed. Rep. F. 555.
¹³ Rhodes v. N. Y. C. & H. R., 28 N. Y. S. 691.
¹⁴ E. & R. R. v. Barnes, 36 N. E. Rep. 1,092.
¹⁵ Ward's Adm'r v. C. & O., 19 S. E. Rep. 389.
¹⁶ Burnell v. West Side, 38 N. W. Rep. 772.
¹⁷ Kennedy v. C. M. & St. P., 58 N. W. Rep. 878.
¹⁸ Kelsey v. S. I. R. T., 29 N. Y. S. 974.
¹⁹ Floyd v. P. & R., 29 Atl. Rep. 396.
²⁰ Wilson v. N. Y. N. H. & H., 29 Atl. Rep. 300.
²¹ C. C. & St. L. Ry. Co. v. Keely, 37 N. E. Rep. 406.
²² Gurley v. M. Pac. Ry. Co., 26 S. W. Rep. 933.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Chicago & Northwestern, 1½ per cent. on the preferred stock, payable April 4.

Cleveland, Cincinnati, Chicago & St. Louis, quarterly, 1½ per cent. on the preferred stock, payable April 1.

Manhattan Elevated, quarterly, 1½ per cent., payable April 1.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Canadian Pacific, annual, Montreal, Quebec, April 3.

Chicago & Alton, annual, Chicago, Ill., April 1.

Chicago & Grand Trunk, annual, Chicago, April 10.

Joliet & Chicago, annual, Chicago, Ill., April 1.

Malone & St. Lawrence, annual, New York City, March 19.

Mohawk & Adirondack, annual, New York City, March 19.

Pennsylvania, annual, Philadelphia, Pa., March 26, for the election of directors.

Pittsburgh, Cincinnati, Chicago & St. Louis, annual, Pittsburgh, Pa., April 9.

Texas & Pacific, annual, New York City, March 20.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The Car Accountants' Association will hold its next meeting at the Palace Hotel, San Francisco, Cal., on April 16, 17, 18 and 19.

The Association of Railroad Air-Brake Men will hold its next annual meeting in St. Louis, Mo., from April 9 to 11. The headquarters will be at the Lindell Hotel.

The Master Car Builders' Association will hold its annual convention at Thousand Islands, Alexandria Bay, N. Y., commencing June 11.

The Master Mechanics' Association will hold its convention at the same place, commencing June 17. Applications for rooms for both conventions should be made to J. B. Wistar and Charles W. Crossman, both at Thousand Islands, Alexandria Bay, N. Y.

The Western Railway Club meets in Chicago on the third Tuesday of each month, at 2 p. m.

The New York Railroad Club meets at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, on the third Thursday in each month, at 8 p. m.

The New England Railroad Club meets at Wesleyan Hall, Bromfield street, Boston, Mass., on the second Wednesday of each month.

The Central Railway Club meets at the Hotel Iroquois, Buffalo, N. Y., on the fourth Wednesday of January, March, April, September and October, at 10 a. m.

The Southern and Southwestern Railway Club meets at the Kimball House, Atlanta, Ga., on the third Thursday in January, April, August and November.

The Northwestern Railroad Club meets at the Ryan Hotel, St. Paul, on the second Tuesday of each month, at 8 p. m.

The Northwestern Track and Bridge Association meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m.

The American Society of Civil Engineers meets at the House of the Society, 121 East Twenty-third street, New York, on the first and third Wednesdays in each month, at 8 p. m.

The Western Society of Engineers meets on the first Wednesday in each month, at 8 p. m. The headquarters of the society are at 1736-1739 Monadnock Block, Chicago.

The Engineers' Club of Philadelphia meets at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturdays of each month, at 8 p. m.

The Boston Society of Civil Engineers meets at Westleyan Hall, 38 Bromfield street, Boston, on the third Wednesday in each month, at 7:30 p. m.

The Engineers' Club of St. Louis meets in the Missouri Historical Society Building, corner Sixteenth street and Lucas place, St. Louis, on the first and third Wednesdays in each month.

The Engineering Association of the South meets on the second Thursday in each month, at 8 p. m. The Association headquarters are at The Cumberland Publishing House, Nashville, Tenn.

The Engineers' Society of Western Pennsylvania meets in the Carnegie Library Building, Allegheny, Pa., on the third Tuesday in each month, at 7:30 p. m.

The Technical Society of the Pacific Coast meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

The Association of Engineers of Virginia holds informal meetings on the third Wednesday of each month, from September to May, inclusive, at 716 Terry Building, Roanoke, at 8 p. m.

The Denver Society of Civil Engineers meets at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesdays of each month except during July, August and December, when they are held on the second Tuesday only.

The Montana Society of Civil Engineers meets at Helena, Mont., on the third Saturday in each month, at 7:30 p. m.

The Engineers' Club of Minneapolis meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

The Canadian Society of Civil Engineers meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday, at 8 p. m.

The Civil Engineers' Club of Cleveland meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month, at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

The Engineers' Club of Cincinnati meets at the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati, O., on the third Thursday in each month, at 7:30 p. m. Address P. O. Box 333.

The Engineers' and Architects' Club of Louisville meets in the Norton Building, Fourth avenue and Jefferson street, on the second Thursday in each month at 8 p. m.

The Western Foundrymen's Association meets in the Great Northern Hotel, Chicago, on the third Wednesday of each month. B. W. Gardner, Monadnock Block, Chicago, is secretary of the association.

The Association of Civil Engineers of Cornell University meets on Friday of each week at 2:30 p. m., from October to May, inclusive, at their association rooms in Lincoln Hall, Ithaca, N. Y.

Engineers' Club of Philadelphia.

The regular meeting was held on March 2, with 72 members and visitors present, and President George S. Webster in the chair. The subject for topical discussion was "The Promotion and Improvement of Rapid Transit in Philadelphia." Mr. William Wharton, Jr., opened the discussion, and after contrasting the conditions in New York and Philadelphia as regards rapid transit, gave it as his opinion that a system of elevated roads would offer the best solution to the rapid transit problem in Philadelphia. This seemed to be the general opinion of those who took part in the discussion.

The next meeting of the club will be held on March 16, and a paper on "Silver Mining in Mexico" will be read by Captain C. B. Dahlgren.

American Society of Mechanical Engineers.

The third Engineering Evening of 1895 was held Wednesday evening. The subject of discussion was "Rapid Transit in Large Cities," and the opening presentation at 8:15 P. M. was given by Mr. W. B. Parsons, C. E., Chief Engineer of the Rapid Transit Commission of New York City. The paper was illustrated by lantern slides. Mr. Geo. S. Morison presided.

The Western Society of Engineers (Chicago).

There was a directors' meeting of the Western Society of Engineers on Tuesday, March 5, in their rooms, and eight new members were elected. The membership is now about 450 and the society is self-sustaining and able to keep its rooms and library, 1736 to 1739 Monadnock Block, Chicago, open during the day. The library was doubled during the past year and now contains about 4,000 volumes, which are catalogued and accessible to the members. The secretary, Mr. Charles J. Roney, may be found at the rooms at any time.

The regular business meetings will be held the first Wednesday of each month at its rooms, and on the third Wednesday papers will be read and discussed at the Armour Institute, Thirty-third street and Armour avenue, Chicago. Lantern slides to illustrate these papers will be prepared by the students of the Institute, and every facility is offered to make these meetings thoroughly enjoyable. The next meeting there will be held March 20, and Mr. Warren R. Roberts, Chicago City Bridge Engineer, will present a paper on "The Van Buren Street

Rolling Lift Bridge." A very full discussion is expected. On March 16, at 2 p. m., members of the society and their friends will visit the new Van Buren street bridge, at the invitation of Mr. Samuel G. Astingall, Chicago City Engineer. An opportunity will also be afforded to inspect the new Metropolitan West Side Elevated Railroad Bridge, just north of Van Buren street.

On Wednesday, March 6, at 8 p. m., the regular monthly meeting was held in the rooms. Mr. Horace E. Horton, President of the society, presided. The business meeting was shortened to give time for the "house warming," it being the first meeting in the new quarter. A very good lunch was spread, and the social meeting of the members and their guests, to the number of 150, continued until 11 o'clock. Most of the offices at the south end of the Monadnock, on the same floor, were open with their occupants to do the honors, among these being the office of Mr. D. L. Barnes, Treasurer of the society; Mr. Geo. S. Morison and Mr. C. L. Strobel.

Association of Engineers of Virginia.

The regular informal monthly meeting of the association was held in Roanoke on Feb. 20, with the President, Mr. J. C. Rawl, in the chair. The subject for the evening, "Photography as an Aid to Engineering," was ably treated by Mr. G. R. Henderson. The next regular informal monthly meeting will be held on Wednesday, March 20, in the office of the Chief Engineer of the N. & W. R. R. The subject for the evening, "The Manufacture of Cement from Furnace Slag," will be opened by Mr. Herman Cruger.

Civil Engineers' Society of St. Paul.

A regular meeting of the Society was held on March 4, with 15 members and 5 visitors present, and President Stevens in the chair.

Mr. Truesdell read a paper entitled "The First Engineer." Nero, in his opinion, was the man to be honored with this title, having been the first to formulate and practically apply, 200 years B. C., the principles of geometry and mechanics.

Mr. Crosby displayed a number of drawings illustrating the solution of some of the problems met with during the construction of the 40-ton crane just completed by his company for the Mare Island Navy Yard.

Lake Superior Institute of Mining Engineers.

This institute held its third annual meeting the past week at Duluth, and inspecting the mines of the Mesaba and Vermilion ranges. Interesting papers were read, and officers for the coming year were elected as follows: John Duncan, Calumet & Hecla, President; Per Larsson, Menominee Range; Frank M. Stanton, Gogebic, and George Newett, Marquette Range, Vice-Presidents; F. W. Denton, Vermilion, Secretary, and Geo. F. Swift, Mesaba, Treasurer.

The Western Railway Club.

The Western Railway Club will meet March 19 at 2 p. m. in the Lecture Hall of Armour Institute, Chicago. The Institute has given special invitation to the club for that day, and it is hoped that all the members will avail themselves of the opportunity thus given to visit that remarkably interesting place. The subjects for discussion are "Signaling," to be based upon the paper on that topic presented at the last meeting by Mr. George Gibbs, and "Stationary Boiler Practice and Shop Heating," which latter topic aroused so much interest at the last meeting that it was continued. The paper of the day will be presented by Mr. C. A. Goodnow, Division Superintendent of the Chicago, Milwaukee & St. Paul, on the Train Staff System. All who are interested in these topics and who will enjoy seeing an exemplification of high-grade manual training work, as conducted at the Armour Institute, are invited to attend the meeting.

Engineering Association of the South.

The Association met on March 9, and Professor Magruder's paper on the "Preservation of Iron Surfaces" was discussed. The next regular monthly meeting will be held on March 14, when the question of semi-monthly meetings will be decided.

PERSONAL.

Mrs. William Bliss, wife of the President of the Boston & Albany, died in New York City on March 11.

Mr. W. E. Foskett, Jr., has been appointed Manager of the Chicago Refrigerator Car Line to succeed Mr. C. E. Mewing, resigned.

Mr. F. B. Daniels, of Dubuque, Ia., has been appointed Assistant General Solicitor for the Pullman Palace Car Company.

Mr. C. E. Martin, Superintendent of Bridges and Buildings of the Florida, Central & Peninsular, died at Starke, Fla., March 2.

Mr. William O. Seymour has been re-appointed State Railroad Commissioner of Connecticut for a term of four years from July 1 next.

Mr. R. H. Parks is now Superintendent of the Elliott Car Co., at Gadsden, Ala. He was formerly with the Madison Car Works, of Madison, Ill.

Mr. W. R. Collins has been appointed Claim Agent of the Minneapolis, St. Paul & Sault Ste. Marie Railroad, with office at Minneapolis, Minn., Mr. J. H. Bradish, the former agent, having resigned.

Mr. George W. Martin, Traveling Freight Agent of the Gulf, Colorado & Santa Fe at Fort Worth, Tex., has been appointed Division Freight Agent of the Atchison, Topeka & Santa Fe, with headquarters at Denver.

Mr. C. C. Pudor, for 14 years Division Engineer of the Madison Division of the Chicago & Northwestern Railroad, died suddenly March 6, of heart disease, at St. Albans, Vt. The funeral took place at Portland, Me., his former home.

Mr. George Dickey has been appointed General Master Mechanic of the Chesapeake, Ohio & Southwestern Railroad at Paducah, Ky. He was formerly Master Mechanic of the Illinois Central Railroad at the shops at Water Valley, Miss.

Mr. Arthur B. Gardner, C. E., a graduate of the Rensselaer Polytechnic Institute of the class of 1891, and an Assistant Engineer with Sooysmith & Co., contracting engineers, died at Elmira, N. Y., on Feb. 21, after a very brief illness.

Mr. Vibe Spicer, signal engineer, an old employee of the Union Switch and Signal Company, for some time past located at Chicago, has recently been appointed Western agent of that company, to succeed Mr. H. H. McDuffee, who has resigned.

Mr. A. L. Knight, General Claim Agent of the Boston & Maine, died at Boston March 4, aged 58 years. He had been in the employ of the company for over 25 years, and

was first connected with the Western Division under the General Manager Furber.

—Mr. Orville Vaughn, General Agent of the Chicago & Alton at Slater, Mo., died at Slater, March 3. He had been connected with the Alton Road since 1854 and was Assistant Superintendent and Master of Transportation at Bloomington, Ill., when he was transferred to Slater.

—Mr. Gerald Holsman, for several years Supervisor of Signals on the New York Division of the Pennsylvania Road, is now Supervisor in the Road Department, having charge of the Jersey City end, known as Division "A." His successor as Supervisor of Signals is Mr. George P. Miller.

—Mr. Scott Mills, Master Mechanic of the Lehigh & Hudson River Railroad, in New York, has recently resigned that position. He has held that office since 1881, and before that was with the New York & Greenwood Lake, now part of the Erie, as Foreman at the Port Jervis shops.

—Mr. T. H. Hiner, locomotive engineer of the Yazoo & Mississippi Valley, has been presented with a gold watch for the discretion shown by him when some train robbers tried to stop his train at Panther Burn, Miss., on the night of Nov. 17 last. The robbers displayed a red lantern, but the engineer suspected that something was up and he took the risk of running past the danger signal. The robbers were subsequently captured.

—Mr. Royal E. House, the distinguished electrical inventor, died at Bridgeport, Conn., on Feb. 25, at the age of 81. Mr. House was the inventor, about 1848, of the printing telegraph, the first device by which telegrams could be transmitted by electricity and printed in ordinary Roman letters at the receiving end of the line. In a patent taken out in 1868 Mr. House described a delicate sounder, for a telegraph apparatus, which embodied the principles of the modern telephone.

—Mr. B. F. Yoakum, General Manager of the Gulf, Colorado & Santa Fe, has been elected Third Vice-President of that company at the recent meeting of the stockholders. This is a recognizing honor of Mr. Yoakum's very able management of the Atchison property in Texas. He became General Manager of the Gulf, Colorado & Santa Fe in May, 1893. Before that he had been connected for nearly 10 years with the San Antonio & Aransas Pass Railroad, being General Manager of that property from its organization in 1893, constructing in the mean time something like 700 miles of railroad.

—Frank A. Wadleigh, of Denver, has been appointed General Passenger Agent for the Rio Grande Western Railway, with headquarters in Salt Lake City. Since September, 1889, Mr. Wadleigh has been Assistant General Passenger Agent for the Denver & Rio Grande. Mr. Wadleigh is a native of Clinton, Iowa, where he was born in 1857. He has been in railroad service since 1880, and always in the passenger department. In 1882 he went to Colorado to serve as ticket agent in Pueblo. Promotions followed rapidly, as he long ago demonstrated fully his abilities as a passenger agent.

—Mr. W. H. Potter, who has been Engineer of Maintenance of Way of the eastern division of the Pittsburgh, Fort Wayne & Chicago Railroad, has been appointed Superintendent of the Toledo division of the Pennsylvania, to succeed Mr. J. S. Morris, deceased. Mr. Potter has been with the Fort Wayne Railroad for the last 19 years, entering the service of the Pennsylvania at Fort Wayne as roadman immediately upon his graduation from Ann Arbor University in Michigan. He was afterwards Supervisor and Assistant Engineer at Allegheny, and in April, 1888, became Engineer of Maintenance of Way of the eastern division of the Fort Wayne line. He is now about 43 years of age.

—S. Otho Wilson, formerly chairman of the State Executive Committee of the Populist party of North Carolina, has been elected a member of the North Carolina Railroad Commission to succeed Capt. Thomas W. Mason (Democrat), whose term of four years expires April 1. Mr. Wilson is said to have no experience or practical knowledge of railroad matters. The other two Democratic members of the commission, E. C. Beddingfield and Maj. J. W. Wilson (the latter chairman and a railroad man of many years' experience), whose terms expire two and four years hence, respectively, will not be removed by a reorganization of the commission by the Legislature, as was thought to be more than probable until this week.

—Mr. J. H. Bennett has resigned as General Passenger Agent of the Rio Grande Western, being succeeded by Mr. F. A. Wadleigh. Mr. Bennett has held the office of General Passenger Agent of the Rio Grande Western since 1892, but before that, for six years he had been General Freight and Passenger Agent, the office being divided in 1892, when Mr. Babcock, recently appointed Traffic Manager of the company, was made General Freight Agent. Mr. Bennett commenced his railroad career on the London & Northwestern in 1869, but he has been on American railroads since 1871. He went to Colorado in 1879, and was with the Denver & Rio Grande Railroad for seven years, part of the time as Auditor, until he went to the Rio Grande Western in charge of its freight and passenger traffic.

—Mr. George E. Street has just been appointed General Manager of the Blue Line (fast freight) of which he has been General Accountant for some years. He succeeds Mr. B. B. Mitchell who resigned some months ago to become General Freight Agent of the Michigan Central Railroad. He has been succeeded as General Accountant by Mr. George A. Gilman, who has been Car Accountant of the Blue Line and of the Canada Southern freight line at Rochester since 1880. He was in the general office of the Chicago & Northwestern for five years previous to 1880. Mr. Street's first position with the Blue Line was as westbound Contracting Agent at Chicago, and he was promoted from that office to be General Accountant in 1879, and soon after removed to Rochester where he has since been in charge of the general offices of the road.

—Mr. A. V. H. Carpenter, the veteran passenger official of the Chicago, Milwaukee & St. Paul, was stricken by paralysis at his home at Milwaukee on Monday of last week and died on March 10. He was one of the oldest and most favorably known railroad traffic officials. He was born at Middlesex, Vt., Nov. 1, 1822, and entered railroad service in 1849 with the Vermont Central as freight conductor, and was later train dispatcher, superintendent's clerk, and chief clerk of the general freight department of the Michigan Southern & Northern Indiana (now the Lake Shore & Michigan Southern). From March, 1856, to June, 1862, he was superintendent's clerk, secretary and treasurer of the Milwaukee & Chicago. In June, 1862, he entered the service of the Chicago, Milwaukee & St. Paul as general ticket and passenger agent, which position he occupied with great credit to himself and his company until Dec. 1, 1890, when he was practically retired on account of age and ill-health.

Since his retirement he has been allowed his full salary, for which he was given the title of consulting general passenger agent. Nearly every official in the city who could leave attended the funeral at Milwaukee. No passenger official in the west commanded a greater measure of respect and esteem from his associates than did Mr. Carpenter.

ELECTIONS AND APPOINTMENTS.

Elmira, Cortland & Northern.—Stockholders of this railroad met last week and elected the following Board of Directors: J. R. Maxwell, J. D. Campbell, John Sherwood, Charles M. Reynolds, William J. Hehre, A. N. Hehre, Frederick Cook, E. R. Reynolds, George S. Edgell, H. W. Maxwell, W. G. Bosworth, W. J. Kelly and Austin Corbin.

Fort Worth & Denver City.—At the annual election of the company at Fort Worth, Tex., March 6, G. M. Dodge was chosen President, K. M. Vanzant, First Vice-President, and S. H. H. Clark, Second Vice-President.

Grand Rapids & Indiana.—At the annual meeting of the stockholders held at Grand Rapids, Mich., March 6, no change in the Board of Directors was made, except that T. J. O'Brien, of Grand Rapids, was elected to succeed the late Senator Francis B. Stockbridge.

Gulf, Colorado & Santa Fe.—At the annual meeting of the stockholders of the railroad in Galveston, Tex., last week, Aldace F. Walker was elected President and Edward King Chairman of the Board of Directors, Daniel B. Robinson, Chicago; George Sealy, Galveston, and B. F. Yoakum, Galveston, Vice-Presidents; John M. Bird, Secretary and Treasurer, Galveston; L. C. Deming, Assistant Secretary, Boston; H. W. Gardner, Assistant Treasurer, New York; John P. Whitehead, Comptroller, Boston.

Mexican Central.—W. C. Carson has been appointed Eastern Agent, with headquarters at 261 Broadway, New York, vice J. J. Allen, resigned.

Mexican National.—W. B. Ryan has been appointed General Eastern Agent at New York, vice G. F. Wilcoxson, resigned.

New York & New England.—Alfred Richards, General Foreman of the East Hartford shops, has resigned his position and has been succeeded by Mr. Murray, General Foreman of the Norwood shops of the company.

Pennsylvania Lines West of Pittsburgh.—W. H. Potter has been appointed Superintendent of the Toledo Division, in place of J. S. Morris, deceased.

West Jersey.—At the annual meeting of the stockholders, in Camden, N. J., March 5, the following Directors were elected: George B. Roberts, Coleman F. Leaming, John M. Moore, George Wood, N. Parker Shortridge, Henry D. Welsh, W. J. Sewell, Benjamin F. Lee, James H. Nixon, Josiah Wistar, William G. Nixon, Samuel Rea, William Bettle, Charles E. Pugh and John P. Green. The Board organized by the election of the following officers: President, George B. Roberts; Vice-President, William J. Sewell; Secretary, James R. McClure; Treasurer, Robert W. Smith.

RAILROAD CONSTRUCTION, Incorporations, Surveys, Etc.

Atchison, Topeka & Santa Fe.—An effort was recently made to have the officers of the Atchison, Topeka & Santa Fe agree to extend a branch of their line from Ottumwa via Albia into Des Moines, Ia., the company being offered an abandoned grade between these points still in a very fair condition. Vice-President Robinson has recently definitely declined to undertake the extension, and states that no extension of any of the company's lines will be undertaken while the property remains in the control of receivers.

Baltimore Belt.—The company has nearly completed the double tracks in its tunnel at Baltimore. This completes the tunnel track-laying except in the opening cut at the Bolton lot, where the tunnel approaches the bell mouth. In this open space four tracks will be laid to relieve the tunnel of possible blockades. Four tracks will also be laid in the tunnel at Howard and Lombard streets, where the downtown station is to be built. The tracks for passenger trains at the station will run under the train sheds to be built underground. The connection of the Belt Line tracks with the main line of the Philadelphia Division of the Baltimore & Ohio road at Bayview Junction will be made this week. With the completion of this work the only other track connection to be made by the company will be the crossing at North avenue.

Columbus, Hocking Valley & Athens.—There is less prospect now of this company soon beginning actual construction work than there has been heretofore. The contest between the company and the Columbus, Hocking Valley & Toledo, over part of the right of way of the C. H. V. & A., has reached the point where the constitutionality of the law granting the right of way is to be taken into the United States Courts. Heretofore the legal contest has been confined to the County Courts. So long as it was kept there, it could go no higher than the State Courts, and an early decision was possible.

Flint & Pere Marquette.—A good deal has been published recently in the local papers about an extension of this line into Toledo, O., from its present terminus. It had been asserted that the right of way has been secured and the work let to Detroit contractors. S. T. Crapo, the General Manager, has, within a day or two, made a complete denial of this report. Nothing has been done, he says, during the last six months looking toward the extension of the line into Toledo, and no steps toward the building of this extension will be undertaken until business conditions materially improve. The building of an independent line into Toledo has long been discussed by officers of the company, and about a year ago it seemed likely that the building of the line into Toledo would be at once undertaken. These plans, however, were delayed, and, as stated, nothing has been done for the last six months.

Monterey Mineral Belt & Terminals.—Track-laying on this railroad at Monterey, Mex., has commenced and is being pushed very rapidly. It is an important short-line undertaken to reach a rich mining district in addition to connecting all the manufacturing establishments of the city with the Monterey & Mexican Gulf and the Mexican National railroads.

Moss Point & Pascagoula.—The company has recently completed the short southern extension of its line into Pascagoula, Miss., on the Gulf Coast. This extension gives the company six miles of railroad in operation from Moss Point, a point on the Southern Pacific.

New Roads.—The Alameda Sugar Company has secured the right of way from the Alvarado crossing, between Haywards and Decoto, Cal., to the mill at Alvarado, for a road between the two points, about two miles long.

Northern Pacific.—A good deal has been published recently about plans of the company to change its narrow gage branch lines in Idaho to standard gage. These reports are entirely unauthorized, and the company contemplates taking up no work of this kind. It operates at present 24 miles of narrow gage track in the Cœur d'Alene region in Idaho, between Wallace and Mission, this track forming part of the Cœur d'Alene Railway & Navigation Company, which was leased by the Northern Pacific some years ago. This branch line will very probably be changed to standard gage at some future time, but nothing is being done at present to carry out this idea. This 24 miles of track is the only piece of narrow gage track owned or operated by the Northern Pacific Railroad.

Norfolk & Camden.—A bill to incorporate this railroad company has passed the North Carolina Legislature. Only a general survey of the road, which is intended to traverse certain sections of eastern North Carolina to Norfolk, Va., has yet been made, and work on the road will not begin for some time, probably not during the present year.

Nova Scotia South Shore.—The financial difficulties of this company were referred to in an item in this column last week. It was then stated that Mr. R. G. Hervey, of 15 Wall street, New York City, was President of the South Shore Railroad of Nova Scotia. Mr. Hervey is not an officer of the company and has never had any connection with it. He is President of the Nova Scotia Southern Railroad, an entirely distinct corporation. That company has now under construction a line from Shelburne through Nova Scotia to New Germany, where it makes a junction with the Nova Scotia Central Railroad, a distance of about 76 miles, with a branch to Liverpool Harbor. The South Shore project was for a line from Yarmouth along the coast to Shelburne, and is in opposition to the Nova Shore Coast Line, which is building between the same points. T. G. Burgin, of Brooklyn, N. Y., was President of the South Shore Company, but resigned the office a few months ago.

Pennsylvania Midland.—This road is under construction from Cessna, a station on the Dunnings Creek branch of the Pennsylvania to Brook's Mills, a station on the Pennsylvania Railroad near Holidaysburg, a distance of 24 miles. The stations will be as follows: Cessna, Osterburg, Imler Valley, Greenfield, Sarah Furnace, Claysburg, East Freedom and Brook's Mills. The projected terminal points of the road are Hyndman, in Bedford County, and Altoona, in Blair County, 62 miles, and a branch of 20 miles from Osterburg to Ashtola, in Somerset County, is also proposed. The surveys are completed on the line from Cessna to Brook's Mills, and partially located from Osterburg to Ashtola. A contract was let to E. A. Tennis, of Thompsontown, Pa., for furnishing all materials and constructing the lines from Cessna to Brook's Mills, but Mr. Tennis was compelled to surrender the contract. The contract for finishing the work has not been let, nor has the contract for building line from Osterburg to Ashtola been given out. Twenty miles has been graded, and seven miles of track laid up to Dec. 31, last. On the line Cessna to Brook's Mills the work is very light, averaging about 7,000 cu. yds. a mile, with a maximum grade of 34 ft. a mile, and maximum curves of five deg. The line from Osterburg to Ashtola has a maximum grade of 98 ft. a mile and a maximum curve of 12 deg. The excavation averages 35,000 cu. yds. a mile. There are no bridges of importance on any part of the line. J. Murray Africa is Chief Engineer, with headquarters at Huntingdon, Pa.

Pittsburgh, Monongahela & Wheeling.—The incorporation of this company in Pennsylvania was recently noted. This company has been organized to build a railroad from Monongahela City, Pa., to Wheeling, W. Va., a distance of about 50 miles. In addition to its charter from the State of Pennsylvania, the company is authorized by a special act of Congress to bridge the Monongahela River, and an expensive steel structure will span the river at or near the Monongahela City, at which point connections will be made with both the Pittsburgh & Lake Erie Railroad and the Pennsylvania; at Wheeling, connection will be made through the Wheeling Terminal company with all roads entering that city. The new road will develop the great coal, timber and agricultural resources of Washington and Greene counties, in Western Pennsylvania. The road will be constructed and operated as an independent road, and as the coal properties on this line are located within the 50 mile belt of Pittsburgh, shippers will receive the benefit of the Pittsburgh differential on all freight to lake ports. The work of construction will be of a heavy and expensive character, but the projectors expect that the heavy business awaiting the completion of the road, and to be developed by the building of this line, will fully justify the outlay. The funds for construction will be furnished by Philadelphia and New York capitalists. The directors of the company are residents of Pittsburgh, Philadelphia and New York. William G. Dacey, Esq., of 40 Wall street, New York, is the President of the company.

Pittsburgh & Lake Erie.—The company has just completed a branch line six miles from the state line to the limestone quarry at McGillsville, Pa.

San Antonio & Brownsville.—The officers of this company hope to have the construction work south of San Antonio begun within 60 days. The railroad is projected from San Antonio south to Brownsville, at the mouth of the Rio Grande river on the Gulf of Mexico, and a deep water seaport. The officers claim that their line will shorten the distance from northern points to the City of Mexico, nearly 270 miles, as compared with the shortest of the present lines. They say that they have made arrangements for funds to complete the first section of the line, and that the contract will be let very shortly to reliable contractors.

St. Louis & Kansas City.—This company has been recently incorporated in Missouri. The company is formed for the purpose of building a line of road from Green Ridge, Mo., Pettis County, through the counties of Pettis, Johnson, Cass and Jackson to Kansas City; capital stock, \$1,150,000. The incorporators are: J. H. Hill, Robt. Maguire, J. M. Bryson, James Hagerman and F. A. Leland. Although organized under a separate charter this road will be part of the Missouri, Kansas & Texas. It will not be built, at present, to Kansas City, but only from Green Ridge to Holden, Mo. From Holden to Paola the M. K. & T. has a line of its own, now leased to the Missouri Pacific, and from Paola it runs into Kansas City over the Kansas City, Fort Scott & Memphis tracks, operating its own trains. The com-

pletion of the road will give the Missouri, Kansas City & Texas a line from St. Louis to Kansas City.

St. Paul, Minneapolis & Ashland.—C. H. Pratt, of Minneapolis, Vice-President of this company and chief promoter of the project, has asked Bayfield County, Wis., to subscribe \$100,000 as a bonus for the railroad which is to be located for 35 miles through that county.

GENERAL RAILROAD NEWS.

Bristol, Elizabethton & North Carolina.—Judge Hugh Kyle, of the State Court at Bristol, Tenn., has ordered the sale of the railroad, which has been in the hands of Receivers Frederick M. Leonard, of Philadelphia, and Benjamin L. Dulaney, of Bristol, for several years. The road runs from here to Elizabethton, Tenn., 22 miles, near the iron mines at Cranberry, N. C. It was built principally by Bristol capital. The date of the sale has not been fixed.

Colorado Midland.—A hearing was given counsel of the Bondholders' Committee and the Railroad Company by Judge Caldwell, at St. Louis, Mo., March 6, on an application for a separate receivership. The grounds argued for such a change were that under present arrangements the Colorado Midland was not able to avail itself of its full earning capacity, and the committee believed that if it was operated as a separate receivership that more advantageous traffic arrangements could be made than were now in effect. Judge Caldwell denied the petition, stating that he did not propose to make any change in his Receivers pending the issuing of the forthcoming plan or reorganization of the Atchison system, and stating that he would hold the matter in abeyance until that time, and that, if in the meantime the Colorado Midland bondholders desired, they could press their foreclosure suit and obtain possession of their property in this way.

Georgia Southern & Florida.—The attempt to sell this property at Macon, Ga., on March 6, failed, no bids at the price fixed by the court, \$4,500,000, being made. The property will again be offered for sale with a fixed price of \$3,750,000, and if not sold offered every two weeks at decreasing upset prices until a sale is made. Simon Borg & Co., a firm of New York bankers, representing certain of the bondholders who have declined to assent to the reorganization plan, attempted to secure an order from the court postponing the sale under foreclosure, but this was denied by the court. As stated, however, no bid was made at the amount fixed. The property will probably be bought in by the Bondholders' Committee, who represent about \$3,000,000 of the first mortgage bonds, the full amount of which is \$3,420,000. The Bondholders' Committee is composed of Baltimore bankers who have long been interested in the company.

Grand Rapids & Indiana.—The annual report for the year to Dec. 31 gives the gross earnings as \$2,464,956, a decrease of \$342,330. The operating expenses, including taxes, were \$1,873,660, a decrease of \$456,252, and net earnings \$591,296.03, an increase of \$83,921.59. However, after paying interest, there is a deficit of \$343,000.

Green Bay, Winona & St. Paul.—In consequence of the proposed foreclosure of the railroad, under the consolidated mortgage, holders of a large amount of the income bonds and preferred and common stocks of that company have requested Messrs John I. Waterbury, President of the Manhattan Trust Company; Edwin S. Hooley and Meyer Lehman, of New York, to act as a Committee to protect their interests.

New York & New England.—At the annual meeting of the stockholders of the railroad held at Boston, March 12, the old directors were re-elected. The reorganization committee has 233,259 shares, but the by-laws of the company permit one person to vote no more than one-tenth of the capital. The reorganization committee voted a part and Gordon Abbott voted a part. Mr. Coolidge of the reorganization committee said that there was nothing to report but progress. The necessary legislation had passed in Connecticut, and when the Rhode Island Legislature meets in April it should also be passed there. The progress of the reorganization has been all that anyone with knowledge of the details of law and legislation had reason to expect. Less than 3,500 shares of common stock remained unassessed, and less than 500 shares of preferred stock.

Northeastern (Georgia).—Something like \$200,000 of the present bonds of the railroad have been deposited with the State officers at Atlanta, Ga., for re-funding. The railroad is controlled by the State of Georgia, the State having guaranteed the bonds of the company some years ago, and when the default was made in interest payments, the officers of the State took control of the property and have since been operating it. Until that time it had been operated as a branch of the Central of Georgia. The road is about 46 miles long, running from Athens to Lula, crossing the main line of the Southern Railway. The present issue of bonds will be replaced by a new issue bearing 3½ per cent. interest. It is not the intention to have the State continue the operation of the railroad, but the property will be leased or some other arrangement made for its operation by an independent company.

Pennsylvania.—The annual meeting of the stockholders was held at Philadelphia on March 12. The annual report, reviewed in this journal last week, was read and approved by the stockholders. President Roberts made an address, reviewing some of the conditions under which the property has been managed in the last year. He pointed out that the business depression affected the company with extraordinary severity, the revenues depending largely upon the mining manufacturing, and especially the iron manufacturing, industries of the country. "None of the other railroad lines, at least of the magnitude of the Pennsylvania, depends so much upon the industries referred to; they cover a more varied class of traffic, but wherever the depression is most severe the rebound generally is most generous, and we may hope that prosperity is not far distant, when the industries referred to will again get into their normal condition, and that the revenues will be what they were a few years ago. The return that the property makes to its shareholders is infinitesimal as compared with the return it makes to the great country which it traverses. It has always been a thought in my mind that the larger railroads, at least, of the country, owe largely to the public and the States which gave them birth, and the management of the Pennsylvania Railroad Company has always been mindful of that. I take it that that policy, which has been pursued by this company from its first inception, now 48 years, has brought with it the prosperity which you now enjoy, and when the management of your company departs from that rule, and looks more to a return to its individual shareholders than it does to the interests of the community which it is called upon to serve, from the moment it turns its mind in that direction it will be in a struggle with those communities; but a continued effort to serve them, as we believe we have, will

always be met, in my judgment at least, with a generous return from these communities sooner or later, and give to you that measure of prosperity which you are entitled to receive. The report presented this year is a report coming from a season of marked depression, and I do not wish to predict that the present year will be any more successful than the past—probably it may be worse—but the conservative manner in which your properties have been treated in the past would seem to indicate that the adversities that have come to you up to the present time can be reasonably met, and I believe that the adversities that may come in the future ought to be quite as well met, and that your properties will be sustained in high condition in which they are to-day.

"Our English shareholders must remember that the management of railroads in this country is very different from what it is in England. There they divide up their profits closely; they are well protected in every way, and they are held strictly to an accountability to the public. In this country we are young. We passed through nearly half a century of railroad enterprise before we had any laws in this country defining specifically the relations between the railroad corporation and the public. When the Government did finally step in to regulate this matter, it was, of course, like all our legislation in this country more or less crude and radical, and until we get in to the position in which we are protected against each other's encroachments and against unbridled competition, and the public is regulated in its reference to its dealings with the transportation interests, as the transportation interests are regulated in their dealings with the public—until that time comes, it is absolutely necessary for an enterprise of the character of the Pennsylvania Railroad Company to hold itself strong, to be able to take care of itself, and nothing less than that will bring you safely through the trials that come to you."

Port Royal & Western Carolina.—Judge Simonton, of the United States Circuit Court at Georgia, has recently issued a decree providing for the sale of this railroad on April 1. The road was formerly operated by the Central of Georgia, but the security holders of the company secured the appointment of an independent receiver for the property. The company operates about 135 miles of railroad from Augusta north to Spartanburg, N. C., forming a connection between the Port Royal & Augusta, and at Spartanburg with the Asheville & Spartanburg Railroad, recently taken over by the Southern Railroad. It seems very probable that the road will be purchased by the Southern Railway, as its control will give that company a through line from Asheville into Augusta.

Union Pacific.—Congress having failed to make any provision for the settlement of the debt due to the United States Government by the company, the organization which was formed to prepare a plan of reorganization has dissolved. This committee included Senator Calvin S. Brice and Messrs. J. P. Morgan, Louis Fitzgerald, G. M. Dodge, H. L. Higginson, A. A. H. Boissavain, and Samuel Carr. The securities deposited under the call of the committee will be returned to the owners. The preliminary plan of the Reorganization Committee of the road provided that if by March 4th, 1895, a permanent plan had not been brought out by the committee, securities could be withdrawn, as non-action on the part of Congress would make a reorganization impossible at this time.

TRAFFIC.

Traffic Notes.

The Erie and the Lackawanna roads have decided to sell no more mileage tickets. When this fact became known there was a rush at the ticket offices and most of the agents sold all the tickets they had on hand. At Wilkes-Barre, Pa., 600 tickets were sold within two hours.

The railroads carrying coal from Ohio mines to Lake Erie ports have come to an agreement on freight rates, which is designed to remain in force until Nov. 30, 1896.

The Southern Passenger Association was reorganized in Atlanta March 8.

The New York man who guaranteed the expense of a passenger train from New York to New Haven on Sunday nights has given up the scheme. It is said that he has paid for six trains at about \$140 each.

Among the roads composing the Southern Railway & Steamship Association is the Western & Atlantic now leased to the Nashville, Chattanooga & St. Louis, and this company therefore is a party to the action taken by the Association cutting off through rates with the Seaboard Air Line. But the latter has found a clause in the lease of the Western & Atlantic to the N. C. & St. L., which is believed to forbid any such "boycotting" action against any road, and it has therefore secured an injunction restraining the N. C. & St. L. from discriminating against the Seaboard Air Line. The stipulation in the lease is to the effect that the N. C. & St. L. shall at all times grant to every connecting road equal traffic facilities. The hearing on the injunction has not yet been appointed.

The Pennsylvania and the Erie have decided not to discontinue the issuance of reduced fare permits to clergy men. The Trunk Line Association voted that each road might do as it pleased in this matter.

Street car fares in Savannah have been restored. The opposition companies complied with the order of Judge Speer, of the United States Court, and the Judge then authorized the receiver of the road in the hands of the court to charge either 3 cents or 5 cents, as they might see fit.

The United States Supreme Court has taken a recess, and it appears that the cases of the Texas & Pacific and Cincinnati, New Orleans & Texas Pacific against the Interstate Commerce Commission and of the Commission against the Cincinnati, New Orleans & Texas Pacific, will not be decided for sometime yet. They have been restored to the docket for argument at the next term of court.

The Superintendent of the Chicago & Erie has suspended for 10 days the conductor, train and station bagagemasters, who assisted in handling the corpse of a child whose death resulted from diphtheria. It appears that the father of the child was connected in some way with the road.

Chicago Traffic Matters.

CHICAGO, March 13, 1895.

The Western Trunk Line Committee are in session to-day endeavoring to patch up the rents in the western agreement. It is admitted that rates are not being maintained. This is especially true in the southwest, and several of the lines are threatening to openly reduce their tariffs to meet the situation. To add to the dissatisfaction, some

of the lines who are ahead of their allotted percentages are clamoring for a re-adjustment on the ground that their tonnage has shown that they can carry more than has been set aside for them. Naturally the lines who are short claim that the lines who are clamoring for a revision have been attracting tonnage by secret concessions in order to make a showing that will warrant their demands. The Atchison, in particular, is a heavy creditor under the traffic distribution agreement and is very much dissatisfied at the way things are going.

Commissioner Blanchard has the Central Traffic Association members gathered here to-day to see what can be done to steady rates eastbound. While there is some little improvement from Chicago, the situation east bound from St. Louis is reported to be worse than ever.

Passenger officials are working away at the details of the new western passenger agreement and are making good progress in the formation of the various divisional committees. The Grand Trunk is being supported by the Alton in its demand for permission to make the same rates via Chicago as are allowed the Canadian Pacific via Port Arthur from Grand Trunk territory.

The Wabash has issued a supplementary notice to the effect that its mileage coupons will be accepted for seats and meals only in cars owned and operated by itself.

The Chicago & Northwestern is making a determined attempt to compel the "purchasing agents" who come into Chicago from suburban towns to fill orders entrusted to them by their patrons, to ship their purchases by express. The practice has become so general that it not only proves a nuisance, but is causing the express company to protest against allowing these buyers to carry their purchases with them in the coaches and baggage cars.

Some weeks since some of the competitors of the Nickel Plate made complaint that this line was furnishing the brokers with tickets at such figures as enabled them to materially cut the tariff rates. President Callaway emphatically denied the charge, and now it is stated that a further investigation has satisfied the other lines that the brokers "put up a job on them," and sold at cut rates tickets for which they had paid the Nickel Plate regular rates, hoping thereby to break the agreement.

The Atchison will restore the second class eastbound passenger rate from Pacific Coast points, but still claims that its action was justified.

The shipments of eastbound freight, not including live stock, from Chicago by all the lines for the week ending March 9, amounted to 55,324 tons, against 58,768 tons during the preceding week, a decrease of 3,444 tons, and against 86,955 tons for the corresponding week last year. The proportions carried by each road were:

Roads.	WEEK TO MARCH 9.		WEEK TO MARCH 2.	
	Tons.	p. c.	Tons.	p. c.
Michigan Central.....	3,678	6.7	4,778	8.1
Wabash.....	4,426	7.9	5,156	8.8
Lake Shore & Mich. South.....	5,182	14.8	6,194	10.5
Pitts., Ft. Wayne & Chicago.....	8,248	14.9	10,805	18.4
Pitts., Cin., Chi. & St. Louis.....	4,584	8.3	5,067	8.6
Baltimore & Ohio.....	2,637	4.8	3,011	5.1
Chicago & Grand Trunk.....	4,285	7.7	5,779	9.8
New York, Chic. & St. Louis.....	11,755	21.2	7,220	12.3
Chicago & Erie.....	5,972	10.7	9,073	15.5
C., C., C. & St. Louis.....	1,662	3.0	1,695	2.9
Totals.....	55,324	100.0	58,768	100.0

Of the above shipments 5,498 tons were flour, 22,921 tons grain and mill stuff, 11,555 tons cured meats, 6,173 tons dressed beef, 1,364 tons butter, 1,265 tons hides and 5,172 tons lumber. The three Vanderbilt lines carried 42.7 per cent., the two Pennsylvania lines carried 23.2 per cent.

Railroad Competition for Export Grain.

Between Dec. 15, when the east-bound movement of corn began to count in the statistics of the country's exports, and March 7, the shipments of wheat and corn to Liverpool compared as follows from the principal Atlantic ports:

	Bushels.	Fer Ct.
Newport News and Norfolk.....	1,080,000	26
Boston.....	1,052,000	26
New Orleans.....	680,000	16
New York.....	612,000	15
Baltimore.....	536,000	13
Philadelphia.....	176,000	4

These figures point anew the advantages of competition, and indicate the extent of the rate cutting that must have been in progress in order to divert the lion's share of the business away from New York, Baltimore and Philadelphia to Newport News and Norfolk and to Boston.—*Philadelphia Record*.

The Southern States Passenger Association.

The convention of passenger agents and executive officers of the Southern roads, which met in Atlanta last week, decided that the new agreement "the Southern States Passenger Association" should go into effect April 1. A committee of five was appointed to report March 27 on officers.

The Stock Yards Switching Charge.

The Illinois Railroad Commissioners last week gave a hearing on the complaint of James Brown against the Chicago & Alton for alleged discrimination in charging \$2 switching charge on a car of hogs consigned to the Union Stock Yards, Chicago. The case was a test case of the switching charge matter, and it is understood that Brown is being backed by several of the heavy concerns at the yards. The Alton set up in defense that the Stock Yards are not a station on its line; that it has proper facilities of its own for the delivery of live stock, but that shippers refuse to make use of them and demand the delivery at the Stock Yards; that the charge of \$2 is not unreasonable in view of the tax imposed on the road by the Stock Yards Association and the expense involved in delivering stock at the yards. In the course of the hearing one of the witnesses made the sensational charge against the Alton that it was enforcing the \$2 charge only from points in the state where it did not come into competition with the Atchison, and produced a batch of expense bills to prove his statement. The commission ruled the evidence out as not pertinent to the case, saying that it might be made the basis of another complaint. It will be remembered that after the Atchison was compelled to abolish the switching charge by order of the United States court, the other lines agreed that they would continue the charge notwithstanding the decision. Naturally, it was thought that the Atchison would get the larger portion of the business, not imposing the charge. This did not prove to be the case, and now the cat is out of the bag. The commissioners took the matter under advisement, and will render a decision later.